ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

L. W. W. MORROW, *Editor*

ALLEN M. PERRY
Managing Editor

A. E. KNOWLTON
Associate Editor

E. R. SEARLES
News Editor

G. F. WITTIG
Statistical Editor

EARL WHITEHORNE
Contributing Editor

JAMES H. RUDD
Publishing Director

FRANK R. INNES
Western Editor
520 N. Michigan Ave.
Chicago

C. W. LEIHY
Pacific Coast Editor
883 Mission St.
San Francisco

H. S. KNOWLTON
Contributing Editor
1427 Statler Bldg.
Boston

PAUL WOOTON
Washington
Correspondent
National Press Building
Washington

What in the World!

Our contemporaries, one stolid and conservative, the other bright and quite gay, who respectively label their published correspondence from readers "The Editor's Easy Chair" and "The Editor's Uneasy Chair," have our every admiration for their frankness. Be completely conventional and you are surrounded by the "contented cowed." Be frank and intelligently critical and you have——interesting correspondence.

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We have been hearing lately from our friends who find our weekly comments upon business conditions "anti-administration." They are not anti-anything. But they are constructively designed to point the dominant factors and developments of the business week, orienting in the light of non-hysterical perspective the probable results to be anticipated.

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We also try to be constructively critical on codes. They are not easy to develop or to apply, especially with respect to trade practice clauses. Needless to say, the labor aspect also engages attention. The codes are here and must be used and we try to point out how to use them intelligently and in the interest of all elements in the industry.

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Thus there is no lull for editors this summer. Readers are eager for the latest news. They vigorously agree or take issue with editorial statements and interpretations. No yardsticks are available to measure many of the new and revolutionary changes, so that reasoned opinions only can be given, and many schools of thought exist, therefore these opinions differ. We try to minimize our personal opinions and emphasize interpretations. But we do both and will continue to do so, because this is our idea of editorial service.

Photo courtesy General Electric Company

AUGUST 12, 1933

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VOLUME 102 . . . NUMBER 7

Polyphase Meter Connections Checked by Timing Rotation 204
By A. F. NEWMAN and M. MINIKES,
New York & Queens Electric Light & Power Company

Italian Electric Railroad Operation 210

How Central Hudson Builds Load Through Dealers 213
By EARL WHITEHORNE

Fire Protection Minimized 220
By E. B. SHEW, *Philadelphia Electric Company*

Where Did It Go? 207
Fault Currents Low with Heavy Power Capacity 208
Electrical Orders Up; Production Too 209
Detector Locates Low-Resisting Open Faults 209
Analyzing Plans for Bulk Supply of Energy 212
Synchronizing and Pitting of Propeller Waterwheels 222
Readers' Forum 222
Men of the Industry 223
New Equipment Available 224

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PHILADELPHIA

ELECTRICAL WORLD

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for the Week Ending

August 12, 1933

Light and Power Code Submitted

Edison Electric Institute presents code for electric utilities.
Hartford and Baltimore companies offer resignations, pleading inability to meet provisions under state regulation.
Electrical manufacturing code signed by President Roosevelt.
Other industry branches preparing and presenting pacts.

CO-OPERATIVELY working with the American Gas Association, the Edison Electric Institute has prepared a code for the electric light and power industry, as has the gas association for its industry, which has been submitted to NRA Administrator Hugh S. Johnson. The code, it was announced by Floyd L. Carlisle, chairman of the code committee of the Edison Electric Institute, would add 50,000 employees to the 350,000 persons now employed by the power and gas industries in the United States. Any increase in numbers will be gradual because of the necessity of training new men to assist those whose working week is to be shortened.

The code submitted provides a maximum 40-hour week and for minimum wages. The 48-hour week is generally observed now throughout the industry, because of the 24-hour daily service required of utilities. Men now engaged in "continuous process" shifts will continue on a 48-hour week until new men have been trained and operations been adapted to a 40-hour week.

Because utilities are service industries in continuous operation day and night, some modifications of the President's re-employment agreement were necessary and at General Johnson's suggestion the code was submitted promptly that the provisions covering these special conditions might be substituted for the provisions in the standard agreement, thereby entitling the members of the industries to receive the Blue Eagle upon execution of the modified agreement.

Two utilities balk

Fortifying their position with advertisements in local newspapers to explain the situation as it affects them, two utilities, Hartford Electric Light Company (including Connecticut Power Company and Stamford Gas & Electric Company) and Consolidated Gas, Electric Light & Power Company of Baltimore, have indicated their inability to sign the code and offered their corporate resignations from the Edison Electric Institute.

Involved in the problem is not the inability of the companies to meet employment conditions, but the question of how public service corporations subject to regulation by state authorities can properly or practically agree to function under the code proposed for adoption by the light and power industry.

The situation is not entirely clear. Richard T. Higgins, chairman of the Connecticut Public Utilities Commission, denies having given advice to the Hartford company regarding the code, but is aware of the theoretical difficulties involved. Samuel Ferguson, president of Hartford Electric Light, states that his organization is not quibbling over the possibilities of conflict between federal and state jurisdictions, but has adopted the spirit of NIRA by arranging to place all employees on a 40-hour week, with no change in wages, as soon as possible.

In Baltimore, President Wagner of the Consolidated company has indicated his full co-operation with regard to wages and employment, but in a letter to General Johnson, drafted with the approval of Harold E. West, chairman of the Maryland Public Service Commission, stated:

"We could not sign the printed form of agreement without necessary exceptions of provisions relating to prices or codes of fair competition and also other necessary exceptions and interpretations as to vital features of our business and our public duties and obligations which are not provided for in the printed form."

Light and power code
(As submitted, subject to revision)

PURPOSE—The declared purpose of this code is to effectuate the policy of Title I of the National Industrial Recovery Act during the period of emergency as to all persons, firms, associations or corporations producing, transmitting, distributing and/or selling electricity.

DEFINITION—The Edison Electric Institute affirms that it imposes no inequitable restrictions on its membership and participation in its activities, and it is truly representative as a national association of the electric light and power industry of the United States.

I. LABOR PROVISIONS—As required by

No Grand Coulee Savings Seen by Utility Head

Doubt that cheap electric power will ever come to the people of the Pacific Northwest from the Grand Coulee Dam has been expressed by Frank Post, president of the Washington Water Power Company.

"If the power companies were released from the burden of taxes and also from the interest on their indebtedness, they also could cut the cost of power in two," he declared. "The people are not going to get this power for any less in the long run, because what they save directly in power costs they will have to make up in taxes to pay for construction of the Grand Coulee Dam."

Section 7 (a) of Title I of the National Industrial Recovery Act, the following provisions are conditions of this code:

1. Employees shall have the right to organize and bargain collectively through representatives of their own choosing, and shall be free from the interference, restraint or coercion of employers of labor, or their agents, in the designation of such representatives or in self-organization or in other concerted activities for the purpose of collective bargaining or other mutual aid or protection.

2. No employee and no one seeking employment shall be required as a condition of employment to join any company union or to refrain from joining, organizing or assisting a labor organization of his own choosing; and

3. Employers shall comply with the maximum hours of labor, minimum rates of pay and other conditions of employment, approved or prescribed by the President.

II. CHILD LABOR—After August 31, 1933, no person under sixteen years of age shall be employed, except that persons between fourteen and sixteen years of age may be employed for not to exceed three hours a day and those hours between 7 a.m. and 7 p.m., in such work as will not interfere with hours of day school.

III. HOURS OF EMPLOYMENT AND WAGES—The following paragraphs in this section III are in substitution for paragraphs 2 to 7, inclusive, of the President's reemployment agreement:

(A) No employee shall work for more than 40 hours in any week except where in emergencies it may be necessary, but the weekly hours for each employee for any 90-day period will not exceed an average of 40 hours per week.

Such employees engaged as load dispatchers, emergency maintenance and repair employees, station and substation operators, with their respective attendants and crews or helpers, who are highly trained and are not readily obtainable, and whose duties must be continuously performed in order to render to the public a safe and continuous service may be employed not in excess of 48 hours per week, except where by reason of emergency they may be required to work more than 48 hours per week on occasion, but the weekly hours for each such employee for any 90-day period shall not exceed an average of 48 hours per week. The Edison Electric Institute will recommend to its members to proceed with the training of additional employees as rapidly as is consistent with the rendition of safe and continuous service, so that as large a number of employees as possible may be reclassified under the 40 hours of employment.

The maximum hours fixed in the foregoing paragraphs shall not apply where not more than two persons are employed in communities of less than 2,500 population, which communities are not part of a larger trade area; nor to emergency employees; nor to people employed on commission; nor to those employed by any member of the industry for only a portion of their working hours; nor to employees in a managerial, executive, administrative or supervisory capacity, who now receive more than $35 a week. Population for the purposes of this agreement shall be determined by reference to the 1930 Federal Census.

(B) No employee shall be paid at the rate of:

(a) Less than $15 a week in any city of over 500,000 population or in the immediate trade area of such city;

(b) Less than $14.50 a week in any city between 250,000 and 500,000 population or in the immediate trade area of such city;

(c) Less than $14 a week in any city between 2,500 and 250,000 population or in the immediate trade area of such city;

(d) In towns of less than 2,500 population all wages shall be increased by not less than 20 per cent, provided that this shall not require wages in excess of $12 a week.

No employee, however, on an hourly rate shall be paid less than 40 cents per hour unless the hourly rate for the same class of work on July 15, 1929, was less than 40 cents per hour, in which latter case the rate of pay shall not be less than the July 15, 1929, hourly rate of pay and, in any event, shall not be less than 30 cents per hour; and, provided that office boys or office girls, learners, and casual employees, may be paid not less than 80 per cent of the minimum wage rate provided in the above schedule, but the total amount paid to such office boys or office girls, learners, and casual employees, shall not exceed in any calendar month 5 per cent of the total amount paid by any member of the code to all employees of such member.

IV. APPLICATION—If any employer in the light and power industry is also an employer in any other industry, the provisions of this agreement shall apply to and affect only that portion of his business which is included in this industry.

V. ADMINISTRATION—The Edison Electric Institute is hereby designated the agency for administering, supervising and promoting the performance of the provisions of this code by the members of the light and power industry. The Edison Electric Institute shall appoint a recovery executive committee to exercise such functions on behalf of the Edison Electric Institute, and the facilities and departments of the Edison Electric Institute shall be available to make the administration effective and efficient.

In order to keep the President of the United States and the administrator informed as to the observance or non-observance of this code, each employer shall prepare and file with the statistical department of the Edison Electric Institute at such times and in such manner as may be prescribed, statistics covering the number of persons employed, wage rates, earnings, hours of work and such other data or information as the recovery executive committee may from time to time require.

Any employer in the light and power industry may participate in this code and in any revisions or additions thereto by signifying his intention and agreeing to pay to the Edison Electric Institute the proper pro rata share of the cost of creating and administering this code.

VI. AMENDMENTS—Such of the provisions of this code as are not required to be included therein by the National Industrial Recovery Act may, with the approval of the President, be modified or eliminated as changes and circumstances or experience may indicate.

Manufacturers' Code Approved

President Roosevelt has signed the electrical manufacturing industry code submitted to Administrator Johnson several weeks ago (ELECTRICAL WORLD, July 29, page 129). This affects the entire industry, except radio manufacturing. The code, as finally submitted to the President, had the full approval of the labor, industrial and consumers' advisory committees.

In commenting upon it General Johnson said, in his report to the president:

"The provisions of the code will result in a substantial increase in wages, and when improvement of business requires the industry to operate at 60 per cent of the 1929 volume there will be employed in the industry a greater number of persons than are to be found at any peak operations."

The revision to Section III made after submission (ELECTRICAL WORLD, August 5, page 161) is, in full text, as follows:

III. (a) On and after the effective date employers shall not employ any one under the age of sixteen years.

(b) On and after the effective date the minimum wage that shall be paid by any employer to any employee engaged in the processing of the products of the electrical manufacturing industry and in labor operations directly incident thereto shall be 40 cents per hour, unless the rate per hour for the same class of labor was on July 15, 1929, less than 40 cents, in which case the rate per hour paid shall be not less than the rate per hour paid on July 15, 1929, but in no event shall the rate per hour be less than 32 cents per hour, and provided, also, that learners may be paid not less than 80 per cent of the minimum rate paid determined in the manner above provided, but the number of learners receiving less than such minimum rate so determined shall not exceed 5 per cent of the total number of employees engaged in the processing of products and in labor operations directly incident thereto.

(c) On and after the effective date the minimum wage that shall be paid by any employer to all other employees, except commission salespeople, shall be at the rate of $15 per week; provided, however, that office boys or girls, and learners may be paid not less than 80 per cent of such minimum wage, but the number of such office boys or girls, and learners paid at a rate of less than $15 per week shall not exceed 5 per cent of the total number of employees covered by the provisions of this paragraph (c).

(d) The minimum rate of wages provided in this article shall apply to all employees in all localities unless the administrator or his representative shall fix a lower rate for particular localities.

(e) Not later than ninety days after the

effective date the electrical manufacturing industry shall report to the administrator through the board of governors of National Electrical Manufacturers Association the action taken by all employers in adjusting the hourly wage rates for all employees receiving more than the minimum rates provided in paragraph (b) of this article.

IV. On and after the effective date employers shall not operate on a schedule of hours:

(a) For employees engaged in the processing of products of the electrical manufacturing industry, and in labor operations directly incident thereto, in excess of 36 hours per week.

(b) For all other employees, except executive, administrative and supervisory employees, and traveling and commission salespeople, in excess of 40 hours per week.

Provided, however, that these limitations shall not apply to those branches of the electrical manufacturing industry in which seasonal or peak demand places an unusual and temporary burden upon such branches; in such cases such number of hours may be worked as are required by the necessities of the situation, but at the end of each calendar month every employer shall report to the administrator through the board of governors of National Electrical Manufacturers Association, in such detail as may be required, the number of man-hours worked in that month on account of seasonal or peak demand requirements, and the ratio which said man-hours bear to the total number of man-hours of labor during said month; and

Provided, further, that these limitations shall not apply in cases of emergency, but at the end of each calendar month every employer shall report to the supervisory agency, hereinafter provided for, in such detail as may be required, the number of man-hours worked in that month for emergency reasons and the ratio which said emergency man-hours bear to the total number of man-hours of labor during said month.

Other codes progressing

The radio industry code previously submitted was amended late last week. It has not as yet been approved.

The code of the National Electrical Contractors Association will, it is said, be submitted to Deputy Administrator Muir shortly for hearings and possible revision.

The wire-covering machine industry has submitted a code through the Braiding and Wire Covering Machine Association.

The Artistic Lighting Equipment Association has submitted a code which would provide 40 cents an hour minimum wage and a 40-hour week. About 90 per cent of this industry is said to be represented by the association. An allowance of 144 hours a year for overtime is provided.

Codes have also been prepared and presented on behalf of the electric storage battery industry and by the American Oil Burner Association.

A Battle to Hold the Lines

Into the current facts of the week creep the materialization of the fears that are besetting Washington. Commodity prices show weakness in extremely dull markets. Steel ingot production wavers uncertainly after tapering off somewhat following the July peak. Freight car loadings decline from the figures of the previous week for the first significant lapse since last May. Automobile output recedes from the peak of the previous week as the production of the three largest makers is sharply cut. Building operations off. Money in circulation declines further. General indexes show falling off. Shipments of cotton to mills 89,000 bales for latest weekly figures, 101,000 the week before, and 150,000 before that. On the other hand, soft coal output rises (due in some measure to widespread drought conditions). Chain store sales and energy production show upward swings.

The electrical industry is in the fore with codes for NRA. The manufacturers' code has been signed by President Roosevelt, and the electric light and power code is ready for hearings. Many other divisions are similarly progressing toward the 100 per cent which is the administration goal. A new attitude on the part of NRA is looked for. No longer to accept "planless planning" as a characterization of its methods, the clarification of a number of points is expected with a declaration of policy.

Just how much of a crisis has arisen in NRA affairs is somewhat problematical, but the insiders are letting drop not-too-well-guarded tips that inflation of the currency is not far away, and that to sustain the wage increases, re-employment programs and spread-the-work pleas it may soon be necessary for the government to advance funds for the harder pressed units of industry to meet payrolls either as an extreme temporary measure or merely as a method of getting the depreciated dollar into circulation.

Power Commission to Draft Electric Development Plan

Under the direction of President Roosevelt, the Federal Power Commission will prepare a comprehensive national plan for the development of water power and the transmission of electricity, examine public works projects referred to it by the Public Works Administration and make a study into the costs of the transmission of electricity from generating stations to consumers, according to a statement made this week by Secretary Ickes. In order to carry forward the administration's plan the Cabinet Advisory Board approved a grant of $400,000 to the commission. This allotment of funds will permit the commission to begin immediate investigations which will be carried on through co-operation with the public service commissions of the various states, the Tennessee Valley Authority and leaders of the electrical industry throughout the country.

Discussing the power survey Mr. Ickes said: "National planning of water-power development, the Federal Power Commission advises the Public Works Administration, will effectuate the purposes of Congress. In the federal water-power act of 1920 the commission was authorized to investigate the water-power industry and its relation to other indudstries and to interstate or foreign commerce, and concerning the location, capacity, development, development costs and relation to markets of power sites. The commission points out that up to the present time the development of the water-power resources of the United States, both public and private, has been carried on without reference to any comprehensive or integrated national plan. . . . The failure to develop a national power program has resulted in great economic loss. It is planned to organize the work on a regional basis so that local projects under the Public Works Administration may receive prompt consideration. Making use of the trained personnel and facilities of the Power Commission will obviate the necessity of setting up a new organization for this purpose within the Public Works Administration."

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New York Governor Asks Utility Legislation

Reviving recommendations regarding legislation for the control of utilities operating in the state, Governor Lehman of New York has asked that the following measures be enacted by the Legislature at its present session:

1. Authorizing the Public Service Commission to charge public utilities with such portion of the cost of special investigations, valuations and revaluations as should reasonably be levied upon the utilities, provided, however, that amount so charged in any calendar year shall not exceed one-half of 1 per cent of the gross operating revenues derived by a corporation from intrastate service.

2. Appropriating $300,000 as a revolving fund to permit the Public Service Commission to engage temporary employees for the expansion of its activities, such moneys to be subsequently repaid to the state by the utilities affected by the work of the commission.

3. Clarifying and extending the powers of the commission to make temporary decreases in rates of the services rendered by public utilities.

4. Requiring gas and electric corporations to pay to the consumers on September 1, 1933, the accrued interest on their deposits and thereafter to make such payment every two years.

Coming Meetings

Economic Conference for Engineers—Johnsonburg, N. J., August 12-20. H. N. Davis, Stevens Institute of Technology, Hoboken, N. J.

National Electrical Wholesalers Association—Buffalo, N. Y., August 14-19. E. Donald Tolles, 165 Broadway, New York.

Illuminating Engineering Society—Delavan, Wis., August 28-31. D. W. Atwater, 29 West 39th St., New York.

Rocky Mountain Electric Association—Santa Fe, N. M., September 11-13. George E. Lewis, Gas and Electric Bldg., Denver, Colo.

International Association of Electrical Inspectors—Chicago, Ill., September 11-14. V. H. Tousley, 612 No. Michigan Avenue, Chicago.

National Electrical Exposition — New York, N. Y., September 20-30. Ralph Neumuller, 480 Lexington Ave., New York.

National Association of Railroad and Utilities Commissioners — Cincinnati, Ohio, October 10-13. James B. Walker, 270 Madison Ave., New York.

Association of Iron and Steel Electrical Engineers—Pittsburgh, Pa., October 17-19. John F. Kelly, Empire Building, Pittsburgh.

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Northwest Association Plans Several Changes

Steps to continue its activities along substantially the same lines as those followed in recent years, but with some definite changes, were taken by Northwest Electric Light and Power Association at its 26th annual meeting held in Portland late last month. While no material change in form was effected, a new membership classification was set up and provision made for financing on a somewhat curtailed budget through nominal dues for all classes of members. L. T. Merwin, vice-president and general manager Northwestern Electric Company, was elected president to succeed J. E. E. Royer, Washington Water Power Company, Spokane, who held that position during the past year. R. J. Moore, president Yamhill Electric Company, Newberg, Ore., was elected vice-president.

The changes effected were recommended in the report of the reorganization committee and this report, complete and comprehensive in all details of association operation, was adopted with a few minor revisions.

New membership classifications include class "A," utility companies; class "B," non-utility companies; class "C," individuals; class "D," honorary. Class "B" provides company membership for manufacturers, jobbers, contractors, dealers or other companies operating in the Northwest territory having an economic relationship with the electrical industry. Class "C" is to include individuals of whatever affiliation with the industry, whether they are employed by a class "A" or "B" member or not. Dues for individual members are $2 a year, for which a subscription to *Electrical West* (McGraw-Hill) is furnished as at present.

Activities are to be carried on under three sections corresponding to three of the sections formerly carried, though with changed names. These are Accounting and Business Practice Section, Business Development Section and Engineering and Operation Section. The report pointed out that this nomenclature meant no material change in the functions of the sections, but was designed to make the names more broadly descriptive of the field now being covered by them.

The territory of the association was broadened to include British Columbia so as to permit inviting participation of the electrical industry in that province, where industry problems are somewhat similar to those in the Northwest states.

Memberships in all classifications are being sought not only among those who formerly held memberships in the Northwest Association by reason of their affiliation with the N.E.L.A., but also among those who because of restrictions imposed by that affiliation did not belong before. It is expected that the simplification of classes and of qualifications for membership will open the way to an even larger membership than the association enjoyed when it functioned as a geographic division of the N.E.L.A.

Activities of the association contemplate committee studies of industry problems within the scopes of the various sections and annual meetings of the three sections in the spring such as have been held in recent years.

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Georgia Ouster Move Dismissed by Court

Dismissal of the ouster proceedings filed by Jule W. Felton, former member of the Georgia Public Service Commission, against B. T. Huiet, named by Governor Talmadge to succeed him (ELECTRICAL WORLD, August 5, page 164), was made by Judge E. D. Thomas in Superior Court after an all-day hearing.

Felton's attorney, Jule Felton, the former commissioner's father, immediately filed notice of appeal and said he would carry the case to the United States Supreme Court, if necessary, alleging that in suspending his son, the Governor had deprived him of his constitutional rights.

The dismissal was ordered when Judge Thomas sustained a demurrer to Felton's *quo warranto*, the demurrer being filed by Assistant Attorney-General J. J. E. Anderson, counsel for the Public Service Commission, who represented Huiet over the protest of the plaintiff.

While Judge Thomas was hearing arguments on the demurrer, Attorney Felton appeared before Judge Edgar E. Pomeroy and obtained that judge's sanction to a certiorari which seeks to bring the entire ouster proceedings conducted by the Governor against Mr. Felton and his former associates on the Public Service Commission before the court for review.

Under the law, the Governor must answer during the next term of court and the judge must rule on the answer.

No compromise in Georgia

Nothing less, or other than, rate reductions by the new Georgia Public Service Commission will be acceptable to Governor Eugene Talmadge, it is announced, thus confirming the contentions of ousted Commissioner Felton that appointments were based on views held. Addressing an audience at Reidville last week the Governor said that he dismissed one commission because it did not reduce rates and added that the new one he recently appointed would meet a similar fate unless it cut utility charges.

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Iron and Steel Engineers Formulate Program

Formulation of the program for the 29th convention of the Association of Iron and Steel Electrical Engineers in Pittsburgh, Pa., October 17 to 19, indicates that the following topics will receive major consideration this year:

Electrical, mechanical, lubrication, combustion developments in the iron and steel industry; improvements in steel plant furnace design; electric furnaces for annealing strip, sheet and tin plate; normalizing furnaces in connection with sheet and tin mills; electric-welded frameless steel houses; developments in electric-welded fabricated rolled steel products; present operating status of electric welding in the steel industry; developments in electrical applications in connection with strip, sheet and tin mills and rectification of electrical power in connection with cleaning blast furnace gas.

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Lights Out in Mexican Row

Through the refusal or inability of municipal authorities of Piedras Negras, Mexico, to pay 1,500 pesos due the Texas Electric Service Company of Eagle Pass, Tex., all street lights in Piedras Negras were turned off last month, since which time the town has been in darkness. As a result of this action on the part of the company light and power consumers in Piedras Negras have instituted a boycott against the electric service and circulars have been distributed almost daily calling on the people to stand firm in support of the city administration in refusing to pay the bill.

Pennsylvania Commission Restrained by Associated

On behalf of the Associated Gas & Electric Company, Federal Judge William H. Kirkpatrick has issued a temporary injunction restraining the Pennsylvania Securities Commission and its counsel from instituting criminal proceedings or otherwise interfering with the reorganization plan proposed by the Associated Gas & Electric Company.

The order was granted to the Utility Investing Corporation, agent for Associated Gas & Electric, which has been threatened with prosecution by the Securities Commission if it carries out its plan to urge Associated debenture holders in Pennsylvania to exchange their securities for those contemplated in the reorganization plan.

Details of the plan were outlined in printed circulars sent to debenture holders, 14,000 of whom have accepted it, according to the Utility Investing Corporation's petition. The company contended that what it intended to do would violate no law of Pennsylvania. In its petition it argued that the Securities Commission had gone beyond its authority, which was limited to granting licenses to brokers for the sale of securities.

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253,634 Associated Owners

As of July 1, and eliminating duplications, there were 253,634 owners of Associated Gas & Electric system securities, as compared with 254,784 at the first of this year. The organization announces that every state and U. S. possession is represented. There are 118,116 customer-owners.

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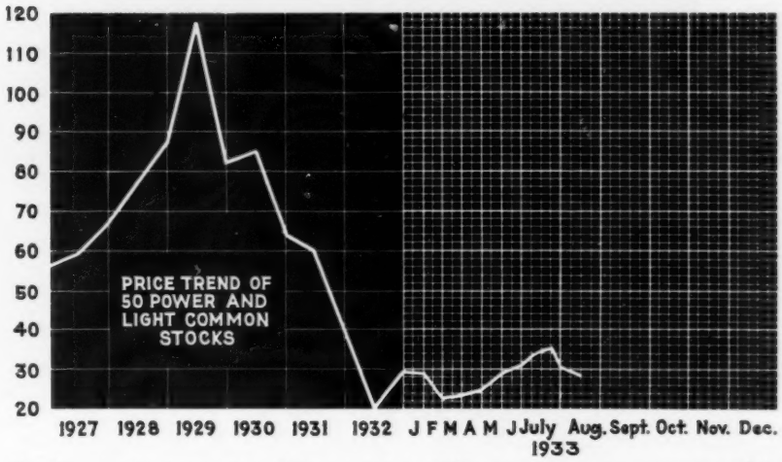
Oregon Bonds Voted Down

Voters of Oregon have rejected by a margin of 104,000 to 72,000 a proposal to issue $103,000 in bonds to finance the activities of a state power commission. The legislative act creating the commission was held up by the referendum and a court injunction, but the bond issue was referred to the voters and defeated.

Stock Prices Continue Weak



Further ground was lost this week by utility stocks as, in common with the general security list, the shares represented in the "Electrical World" average declined. This week 28.5; last 28.9.

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Winnipeg Meeting Adjourned

Bondholders of the Northwestern Power Company meeting in Montreal last week adjourned until October 4 without taking any action. Lieut.-Col. T. A. Vien, chairman, informed the gathering of preliminary arrangements to be in process for a meeting of one-man subcommittees from the various protective groups in Northwestern Power, Winnipeg Electric and Manitoba Power in an effort to reach a satisfactory solution to the problems facing the Manitoba utilties.

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Current Earnings Reports of Electric Light and Power Companies

Operating Companies

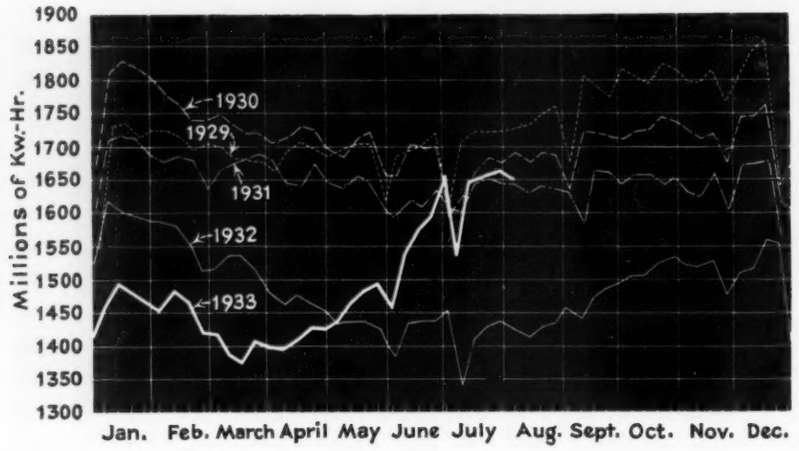
	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
Alabama Power (Year ended June 30)					
Gross earnings	$15,240,647	$16,730,797	— 8.9	48	49
Net earnings	7,852,692	8,494,823	— 7.6	..	..
Net balance	863,125	1,569,616	—45.2	..	..
Brooklyn Edison (Year ended June 30)					
Gross earnings	46,505,007	47,869,653	— 2.8	65	67
Net earnings	15,977,517	15,591,443	2.5	..	..
Net balance	12,995,568	13,073,639	— 0.6	..	..
Consolidated Gas Elec. Light & Power of Baltimore (Six-mos. ended June 30)					
Gross earnings	13,919,752	14,374,663	— 3.2	69	67
Net earnings	4,287,169	4,794,564	—10.6	..	..
Net balance*	280,162	892,371	—68.5	..	..
Consumers Power (Year ended June 30)					
Gross earnings	26,171,317	29,669,977	—11.8	54	50
Net earnings	11,943,728	14,812,366	—19.3	..	..
Net balance	3,142,842	6,386,884	—50.6	..	..
Georgia Power (Year ended June 30)					
Gross earnings	21,877,488	23,760,912	— 7.9	48	51
Net earnings	11,420,101	11,640,361	— 1.9	..	..
Net balance	2,299,691	2,647,936	—13.2	..	..
New York Edison (Year ended June 30)					
Gross earnings	67,506,021	72,826,849	— 7.3	71	68
Net earnings	19,121,636	23,376,028	—18.2	..	..
Net balance	24,709,232	28,367,757	—12.9	..	..
Ohio Edison (Year ended June 30)					
Gross earnings	14,516,236	16,814,773	—13.6	49	45
Net earnings	7,446,984	9,184,873	—18.8	..	..
Net balance	1,717,335	3,685,281	—53.2	..	..
Puget Sound Power & Light (Year ended June 30)					
Gross earnings	$12,724,850	$14,718,411	—13.5	62	61
Net earnings	4,881,802	5,740,933	—14.9	..	..
Net balance	408,221†	745,895	—155.0	..	..
Southern California Edison (Year ended June 30)					
Gross earnings	35,573,930	39,232,924	— 9.3	33	31
Net Earnings‡	23,908,255	26,899,416	—11.1	..	..
Net balance§	16,617,919	19,971,857	—16.8	..	..
Tennessee Electric Power (Year ended June 30)					
Gross earnings	11,201,633	12,850,755	—12.8	58	58
Net earnings	4,738,643	5,410,418	—12.4	..	..
Net balance	523,535	1,330,960	—60.7	..	..

Holding Companies

	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
American Gas & Electric and subsidiaries (Year ended June 30)					
Gross earnings	$62,276,338	$69,240,478	—10.1	53	51
Net balance	7,736,194	11,889,466	—35.0	..	..
Associated Gas & Electric System (Year ended June 30)					
Gross earnings	94,875,287	102,323,286	— 7.0	66	65
Net balance§	31,963,064	35,512,013	—10.0	..	..
United Gas Improvement and subsidiaries (Year ended June 30)					
Gross earnings	109,279,498	118,448,524	— 7.7	48	50
Net balance	29,602,858	32,875,404	— 9.9	..	..

*After all dividends. † Deficit.
‡Operating expenses do not include depreciation. § Available for all dividends.
Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings—Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Net balance—Balance available from income for common stock dividends.

Week's Output Up 15.6 per Cent



Central-station energy output, announced by the Edison Electric Institute for the week ended August 5 as 1,650,013,000 kw.-hr., remains higher than in the summer of any other year except 1929 and 1930. The gain over 1932 was 15.6 per cent, approximately the same as in the two preceding weeks. The highest corresponding week was that of August 3, 1929. Present production is 4.3 per cent short of the record then established.

The region showing the most consistent gains over last year is the Central industrial, which made a record increase of 22.7 per cent. A year ago it was down 16.6 per cent. Three months ago it was just catching up with the extremely low production of 1932. In other regions the gains are moderately smaller than in the week before, but production continues well in excess of last year's.

Weekly Output, Millions of Kw.-Hr.

Week ended	1933	1932	1931	1930
Aug. 5.....	1,650	1,427	1,643	1,692
July 29.....	1,662	1,440	1,644	1,678
July 22.....	1,654	1,434	1,651	1,686
July 15.....	1,648	1,416	1,645	1,667
July 8.....	1,539	1,342	1,604	1,626

Per Cent Change from Previous Year

Region	Week Ended Aug. 5	July 29	July 22
New England.....	+21.3	+24.0	+27.1
Middle Atlantic....	+12.8	+13.6	+11.7
Central industrial..	+22.7	+21.1	+19.2
Southern States....	+17.0	+14.0	+18.6
Pacific Coast.....	+ 5.9	+ 8.0	+ 8.0
United States.....	+15.6	+15.4	+15.4

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Federal Trade Hears of Niagara-Hudson Unit

Corporate activities of the Buffalo, Niagara & Eastern Power Corporation, a holding company of the Niagara-Hudson Power Corporation group, were reviewed by the Federal Trade Commission at hearings held last week. According to Frank Buckingham, examiner, the corporation was organized in 1925 primarily for the purpose of placing under the control of one company the Buffalo General Electric Company, the Niagara Falls Power Company, Niagara, Lockport & Ontario Power Company and the Tonawanda Power Company. The combined book value of the four companies at the time of organization was rated at $62,559,656.

"From its organization in 1925 to August, 1929," Mr. Buckingham said, "control of the company was exercised by the Schoellkopf interests. In August, 1929, control of the company passed to the Niagara-Hudson Power Corporation. During the years 1926 to 1931 the rate of return to the holding company on its investment in common stock of Buffalo General Electric Company ranged from 10.83 per cent in 1927 to 14.35 per cent in 1929. The rate of return on Niagara Falls Power common ranged from 9.39 in 1926 to 15.80 in 1931, on Niagara, Lockport & Ontario Power from 8.23 in 1931 to 12.44 in 1929 and on Tonawanda Power during the same period from 10.96 in 1930 to 23.35 in 1927."

From August, 1925, to December, 1931, the total capitalization of Buffalo, Niagara & Eastern Power increased from $58,394,254 to $103,180,187. In the same period the investments in common stock of subsidiaries and advances to affiliates increased from $58,641,253 to $101,872,458, according to the testimony given. Monthly fees of 5 per cent were paid to the holding company by its subsidiaries for supervisory and advisory services. The salaries of all subsidiary company executive officers were paid by the holding company, however. The total fees collected from 1926 to 1931 amounted to $5,362,640.

The examination was conducted by Robert C. Healy, chief counsel of the commission.

Canadian Output Rises With Economic Recovery

Output of central stations in Canada is rapidly leaving last year's operations far behind. According to monthly figures announced by the Dominion Bureau of Statistics the first definite evidence of recovery came in November, when the preceding year's output for the month was surpassed by about 2 per cent. Following a series of minor losses May brought a pronounced gain and the report for June shows a further advance.

Gains (or losses) in per cent for the first six months of 1933 compared with 1932 were: January –1.2, February –2.0, March –1.2, April –2.5, May +6.0, June +14.2.

Output in June was 1,370,913,000 kw.-hr., of which 21,633,000 kw.-hr. was produced from fuels. Thus water power supplied 98.4 per cent of the total. Production in May was 1,349,942,000 kw.-hr. The June increase over 1932 in production from water power in the province of Quebec was 22 per cent, in Ontario 7 per cent, in the Maritime Provinces 13 per cent.

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Wholesale Energy Gained Nearly 30 per Cent in June

Sales of energy to all classes of ultimate consumers, except for municipal street lighting and electric railway operation, were larger in June this year than last, according to the Edison Electric Institute. Increased industrial activity boosted wholesale energy sales by more than 500,000,000 kw.-hr.: energy for electrified steam railroad operation and sales to municipalities and miscellaneous customers both increased about 30 per cent. Improved conditions were reflected in revenue received from ultimate consumers to the extent of bringing it up to the level of a year ago, whereas corresponding months have for some time been showing a year-to-year decrease.

As announced the energy sales (in millions of kw.-hr.) to ultimate consumers in June and the per cent change compared with June, 1932, were as follows:

Domestic.....	888.7	+ 2.3
Commercial, small lt. & pwr....	997.2	+ 1.6
Commercial, large lt. & pwr....	3,159.2	+20.7
Municipal street ltg.....	142.9	— 8.5
Railways, street & interurban..	304.5	— 3.0
Railroad, electrified steam.....	54.4	+29.3
Municipal & miscellaneous....	56.5	+33.9
Total sales to ult. consumers..	5,603.4	+11.6

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Shoals Power for Cities

Authorization to supply power from Muscle Shoals to Florence, Sheffield and Tuscambia, Ala., has been given by the Tennessee Valley Authority.

National Electrical Show Space 60 per Cent Sold

"With the greatest electrical energy and appliance market in the world—that of the Metropolitan New York area—showing at this time every indication of an upward business trend and requiring new merchandise methods for manufacturer and dealer, alike, who would capture his share of the new market via the New Deal, the 1933 National Electrical Show now scheduled for Madison Square Garden, September 20 to 30, inclusive, is definitely assured of success," according to Ralph Neumuller, managing director of the Electrical Association of New York, sponsor of the exposition.

More than 60 per cent of all available space on the exhibit floors has already been contracted for by the leaders in the electrical and radio industries, with an additional percentage of space reserved for the use of present exhibitors in case they decide to put in more displays, Mr. Neumuller stated.

The following exhibitors have signed for space at the show:

Apex Rotarex Corporation, Atwater Kent Manufacturing Company, Brooklyn Edison Company, Campbell Metal Window Corporation, Commercial Credit Company, Conover Company, Continental Diamond Fibre Company, Crosley Radio Corporation, Delco Heat, Domestic & White Sewing Machine Company, Electrical Testing Laboratories, Emerson Radio and Phonograph Corporation, Electrol, Inc., Fada Radio & Electric Corporation, the Fay Company, Fitzgerald Manufacturing Company, Frigidaire Sales Corporation, Ford Motor Company, General Electric Company, Gibson Electric Refrigeration Company, Graybar Electric Company, Grigsby-Grunow Corporation, Grunow Corporation, Nelson Radio Manufacturing Company, E. Ingraham & Company, Kelvinator Corporation, E. B. Latham & Company, McGraw-Hill Publishing Company, New York Edison Company, Norge Corporation, Nineteen Hundred Corporation, New York & Queens Electric Light & Power Company, Philco Radio & Television Corporation, Petroleum Heat & Power Company, Premier Vacuum Cleaner Company, Proctor & Schwartz Electric Company, Radio & Electric Appliance Journal, Radio Merchant, R. C. A. Victor Company, Sessions Clock Company, Singer Sewing Machine Company, Sparks-Withington Corporation, Stewart-Warner Corporation, Stromberg Carlson Tel. Mfg. Company, United American Bosch Corporation, Utah Radio Products Company, United Electric Light & Power Company, Waters Center Company, Westinghouse Electric & Manufacturing Company.

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To Improve American Homes

Formation of the National Association for Better Housing has been announced. It is said that in the organization architecture, finance, real estate, city planning, research, social welfare, government, building materials and equipment are all notably represented. Among those serving on the organization committee are James S. Adams of Johns-Manville Corporation, C. J. Basslor of the Air-Conditioning Company and N. G. Symonds of Westinghouse Electric & Manufacturing Company. Herbert U. Nelson, executive secretary of the National Association of Real Estate Boards, Chicago, is treasurer, and Henry A. Guthrie, for many years identified with associations in the building field and who has been active in the better homes movement, is secretary, with offices at 59 East Van Buren Street, Chicago.

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Colorado Power Wins Mokelumne Water Rights

By ruling of the California Supreme Court the Pacific Gas & Electric Company has lost its dispute with the Colorado Power Company over the impounding of water of the North Fork of the Mokelumne River for the Pacific Gas & Electric Company power plant at Electra.

The Colorado company has announced plans for a power plant on land it owns 10 miles downstream from Electra and sought to enjoin the Pacific Gas & Electric Company from impounding North Fork water in the Salt Springs, Deer Valley and Lone Bear reservoirs.

The Sacramento District Court denied the injunction, but in so doing stipulated the Pacific Gas & Electric Company was to pay damages to the Colorado company, and gave the latter the right to compel the Pacific Gas & Electric Company to release impounded waters upstream in accordance with a specified plan agreed upon.

Pacific Gas & Electric Company then appealed to the Supreme Court from that portion of the judgment giving the Colorado company right to demand release of the impounded water. The Supreme Court upheld the ruling of the district court.

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Trained Air Conditioning Dealers

About 50 of the 500 dealers who will ultimately represent Westinghouse in the sale of air-conditioning equipment have been selected and trained for sales, installation and servicing. Westinghouse training includes preparation, under a specially designated supervisor, of how to estimate the requirements of a job and how to interpret those requirements accurately and intelligently in terms of the number and type of compressors and cabinets best suited to meet the situation, as well as suggestions for securing prospects, selling talks, slide film, proposal forms and suggestions for follow-up letters after the sale is made.

Major New Construction This Week

Idaho Power Company will build 66-kv. transmission line from Jarbridge, Nev., to Mountain City, Nev., about 30 miles, for service to a subsidiary of Anaconda Copper Mining Company.

Schwartz Brewing Company, Corpus Christi, Tex., plans brewing plant, with power house, refrigerating plant, etc. Estimated cost $400,000.

Transformers, conveyors, motors, controls and other equipment will be installed in glass manufacturing plant of Duplate Corporation, Creighton, Pa. Cost about $300,000.

State Commission of Purchases, St. Paul, Minn., asks bids until August 15 for construction of d.c. power transmission line for Minnesota State Reformatory, St. Cloud, Minn.

Mobile (Ala.) Brewing Company, Mobile, plans extensions and improvements at cost about $200,000.

Metropolitan Water District, Los Angeles, Calif., asks bids until August 17 for construction of 66-kv. transmission line from Colton to Cabazon, Calif., about 35 miles.

Plans approved by Fox Paper Company, Lockland, Ohio, for steam-electric generating plant for paper-mill service. Cost about $100,000.

Department of Commerce, Bureau of Lighthouses, Washington, D.C., has secured appropriation of $71,100 for electrification and improvements in lighthouses in Michigan; also, $155,000 for new light station on eastern shore of same state, Lake Huron; and $26,000 for new light and fog station at Presque Isle Harbor, Marquette, Mich.

Hoffman Beverage Company, Newark, N. J., has authorized plans for multi-story brewery. A $750,000 project.

Dubuque, Iowa, plans ornamental lighting system with underground conduits, comprising 81 double lighting standards. Cost about $21,000.

Schatzbrau Brewing Company, Melrose, Minn., plans new brewing plant. Cost about $125,000 with equipment.

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Kelvinator Sales Up

Reporting upon its unfilled orders on hand now as compared with last year H. W. Burritt, vice-president of the Kelvinator Corporation, shows a five to one ratio. Shipments for the first nine months of Kelvinator's fiscal year already have run more than 40 per cent ahead of shipments for the entire preceding year.

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New York Metal Prices

	Aug. 1, 1933 Cents per Pound	Aug. 8, 1933 Cents per Pound
Copper, electrolytic	9.00	9.00
Lead, Am. S. & R. price	4.50	4.50
Antimony	7.75	7.25
Nickel ingot	35.00	35.00
Zinc, spot	5.35	5.35
Tin, Straits	44.75	44.55
Aluminum, 99 per cent	23.30	23.30

As to Rates——

• Philadelphia Electric Company must show justification for its recent change in rates for Philadelphia, Delaware and Montgomery counties, according to an order issued last week by the Pennsylvania Public Service Commission. The commission dismissed the contention of the utility company that the burden is on dissatisfied customers to prove that the new rates are improper. Hearings on the new rate schedule, which became effective March 2, were halted in May to let the commission pass on the contention that proof of the justification should rest with the company, where the company admitted an increase in rates. During the hearing the sitting commissioner, Frederick P. Gruenberg, ruled that the company would be forced to prove justification for those parts of the new schedule which provided higher rates, and this ruling was sustained by the commission as a whole.

• Public Service Electric & Gas Company through its president, Thomas N. McCarter, has moved before the New Jersey Public Utilities Commission for an indefinite postponement of hearings on the proposed reductions of electric rates (ELECTRICAL WORLD, July 15, page 72) because of changing economic conditions. John A. Matthews, representing the applicant for the reduction, opposed the motion. The commission announced that it would take the motion under advisement.

• New York Power & Light Corporation, with the approval of the Public Service Commission, has extended its standard commercial and power rates for electricity to the districts of Troy, Watervliet and Waterford with a consequent net reduction of $95,000 in bills of commercial customers. The new rates, representing a reduction of 12.2 per cent, became effective July 28.

• Niagara, Lockport & Ontario Power Company has filed two new rates with the New York Public Service Commission, which has approved the rates to become effective August 6 in various small communities. The new rates provide a new flat rate for water heating service and a new rate applicable to all service for customers having installed either an electric range or a water heater.

• New York Public Service Commission heard Grover A. Whalen, speaking for the Retail Dry Goods Association, warn the utilities in the metropolitan area of the intentions of department stores to install private power plants unless reduced rates were ordered quickly. Mr. Whalen stated that if the plans under consideration were carried out the utilities would suffer a great loss of revenue not only for one year but for fifteen or twenty years. Member stores of the association, Mr. Whalen said, consume more than 40,000,000 kw.-hr. of energy and pay the utilities approximately $1,00,000 annually. Milo R. Maltbie, chairman of the commission, to expedite the proceedings, prohibited the introduction of exhibits and consequent testimony relating to reproduction costs, requesting Jacob H. Goetz, company attorney, to confine the testimony to present conditions as a basis for temporary rates.

• East Hampton Electric Light Company rate case was adjourned to September 6 after charges were made at the hearings last week before the New York Public Service Commission that the company, a subsidiary of the Long Island Lighting Company, was paying more for its power under an agreement with the parent company than it would cost to produce its own electricity. Testimony showed that by the terms of the contract with the Long Island company the East Hampton utility agreed to pay 3½ cents per kilowatt-hour for electrical energy, whereas the cost of producing energy at the plant before it was taken over by the Long Island Lighting Company was 2½ cents.

• Louisville Gas & Electric Company's history, corporate structure and its outlays for improvements were discussed last week in the company's case against the city on a rate question. T. Bert Wilson, president; Addison Lee, vice-president, and Arthur H. Kuhn, assistant manager of the valuation department of the Byllesby Engineering & Management Corporation, filed volumes of appraisal figures, copies of contracts, pictures and other exhibits.

• Massachusetts Public Utilities Commission, in a decision on a complaint of the War Department as to the propriety of certain price charges for electricity, gas and water sold to certain units of the department, states: "We think of no sound reason why the United States should obtain its electricity at lower rates than the Commonwealth, or the various cities or towns in which the companies operate, or other customers using like amounts of electricity, under similar circumstances." The War Department complaint was directed against the New Bedford Gas & Edison Light Company, the Edison Company of Boston, Lynn Gas & Electric Company, Suburban Gas & Electric Company, United Electric Light Company and Hingham Water Company. Commissioner Webber dissented from the majority opinion, holding that it would be "a gracious gesture to the present national program" for the utilities to grant the War Department a discount on its bills.

• Illinois Electric & Gas Company has granted a reduction in electric rates in the Rockford district. The reductions, ranging from 15½ per cent on the small accounts down to 6 per cent on the commercial accounts, will mean a saving of $155,000 annually.

• Columbus (Ohio) Railway, Power & Light Company's costs and profits will be examined by a light rate expert appointed by the city so that a report may be made to the City Council by September 27, thus enabling that body to pass a new rate ordinance in time to have it submitted to the voters in November.

• Jacksonville (Fla.) city commissioners will consider no reductions in electric rates for the next twelve months, according to an announcement made by that body last week.

• Interstate Power & Light Company, serving Mineral, Elbe and vicinity territory in the state of Washington, was accused of charging excessive and unjust rates at a hearing which opened last week before the Department of Public Works, Olympia.

• Puget Sound Power & Light Company, dissatisfied with the decision made by the Department of Public Works in the Port Angeles rate case (ELECTRICAL WORLD, July 29, page 136), has filed review proceedings before the Thurston County Superior Court, obtaining a writ of review staying operation of the department's order pending a decision by the court. In the Port Angeles case, first major proceeding to be disposed of by the department in its state-wide attack against rates and valuations of private power companies, only wholesale rates to the city were involved. The department ordered the contract between the city and company vacated and the rates reduced approximately 4 per cent. The company in its petition for the writ attacked the order on the ground it was unreasonable and unlawful. The company also contended a 1933 law giving the department wider powers in regulating public utilities is unconstitutional.

• East St. Louis Light & Power Company in a round-table hearing with the Illinois Commerce Commission held last week refused to submit schedules for rate reductions on the ground that operating costs had mounted in the first half of 1933. If rates were reduced, utility representatives declared, the company would be forced to discontinue its street car service. Engineers for the commission attacked their statement that costs were increased this year, and the company asked time to furnish a detailed statement. The hearing was continued indefinitely.

• Northern Indiana Power Company electric rate schedules for Carthage, revised to effect a reduction of 12.2 per cent, has been approved by the Indiana Public Service Commission.

• South Carolina Power Company's revised rate structure, estimated to save the company's customers $160,000 annually, was accepted last week by the state Railroad Commission. New rates were made effective as of August 1. The company, the rates of which have been under investigation by the commis-

sion for several months, offered last month to make reductions of $151,000 a year. After conferences between members of the commission and executives of the company the proposal was amended to provide additional decreases to residential and commercial consumers.

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International Corrosion Conference

An International Convocation on Corrosion sponsored by the Electrochemical Society will be held at the Hotel Stevens, Chicago, on September 7. Speakers from six nations will collaborate in the discussion of this important topic.

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Air Conditioning in Canada

Said to be the first complete system of air conditioning to be installed in a store in Toronto, and probably in Canada, the new building of the Toronto Hydro-Electric System, comprising a store and mezzanine, has a humidifying and cooling unit and fan located near the boiler room with a system of ducts and full air-conditioning controls.

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Low Water on the Truckee

Because of the low flow of water in the Truckee River in California, the Sierra Pacific Power Company has begun to purchase power from the Pacific Gas & Electric system. The local company is using, at peak hours, between 4,600 and 4,700 kw. from the Pacific Gas & Electric Company through a tie-in on the Sierra summit. One of the Truckee River plants, at the edge of the Reno city limits, is now closed, and within the next two weeks all of the plants along the Truckee will be forced to close.

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Boston Restores Street Lights

Dissatisfaction with the reduction of street lighting in Boston during the past two months as an economy measure has led to a complete restoration of service on order of the City Council and approval of Mayor Curley. About 2,400 lamps had been cut out, representing approximately one-third of the units in the city, with the expectation of saving about $11,000 a month in bills to the Boston Edison Company, which supplies these facilities. So many telephone calls were received by the company reporting lamp outages that each unit cut out of service by the city's order was banded with aluminum for identification. The town of Arlington, also served by the company, tried to save money by cutting out street lighting between 2 and 4 a.m., but after a few days ordered full service restored on account of complaints received.

Municipal Items

CALIFORNIA — According to estimates prepared by E. Randall Ellis, utilities expert and valuation engineer, a fully equipped system for distribution of power to be developed from the Red Mountain Bar power plant, which is included in the $27,585,000 proposed bond issue planned under the national recovery program, would yield a net profit of $150,000 yearly. Mr. Ellis was asked by E. G. Cahill, San Francisco manager of utilities, to prepare the estimates, following a request from the board of supervisors for plans to utilize the power developed at the Red Mountain plant. The Ellis plan, contemplating distribution of power to private, commercial and industrial consumers in the district east of Mission Street and south of Army, provides a $3,500,000 total cost, divided as follows: Red Mountain power plant, $750,000; 41-mile transmission line, Newark to the city, $800,000; step-down station on Amazon tract, $350,000; 7,500-kw. standby plant, $725,000; secondary substation, $150,000; distribution lines, $600,000; interest during construction, $125,000. Mr. Ellis suggests rates 20 to 30 per cent lower than present Pacific Gas & Electric rates.

Voters of Montebello at a special election August 1 defeated a proposed $125,000 bond issue for the purchase or construction of a municipal light and power system. The vote was 725 yes and 665 no. A two-thirds majority was required for passage of the proposal.

Modesto Irrigation District plans to seek a loan of $300,000 from the federal government for extension of its transmission system and erection of a 1,500-hp. hydro-electric plant at Stone Drop on the Tuolumne River.

ILLINOIS — O'Fallon City Council has approved preliminary estimates for the cost of constructing and equipping a municipal light and power plant and distribution system submitted by the W. A. Fuller Company of St. Louis, Mo. The cost was estimated at $123,200 if Diesel engines are used and for a steam unit burning coal at $143,200. The city is now served by the Illinois Power & Light Company, which has refused to grant requested decreases in local rates.

Preliminary report of the Fuller company has also been accepted by the Murphysboro City Council regarding the construction of and equipment for a municipal light and power plant and distribution system. The engineers estimated the probable cost at $374,000. The Council has already applied for a $450,000 loan for this purpose under the national industrial recovery act (ELECTRICAL WORLD, July 29, page 136).

City of Carbondale has applied for a $300,000 loan under the national industrial recovery act to finance the construction of and equipment for a municipal light and power plant. Consulting engineers in charge of the plans estimated the plant complete would cost $298,000.

ST. LOUIS, MO.—That the federal government be asked for a grant of $1,500,000 to complete the city's electric street lighting system has been recommended by Ralf Toensfeldt, the city's chief electrical engineer. An authorized $8,000,000 bond issue provided only sufficient funds to install new lights in two-thirds of the city area. It is estimated 8,000 more electric street lights would be needed. Even though the money is not given the city as an outright grant, Mr. Toensfeldt pointed out, the sum could be paid back in ten years through the saving in the cost of operating the present gas and naphtha lamps.

SANDUSKY, OHIO—An estimate of the cost of constructing a municipal light plant was fixed at $1,400,000 by the Froelich & Emery Engineering Company of Toledo. The city commission is taking steps to give the people an opportunity to vote on the proposal in November unless the Ohio Public Service Company materially reduces its rates.

FORT WORTH, TEX. — Utilities Supervisor A. B. Vickery reported to the City Council last week that construction of the proposed municipal light and power plant would cost the city $4,000,000. This measure is being taken as a last resort to obtain lower rates (ELECTRICAL WORLD, August 5, page 169).

SOUTH DAKOTA—Tentative approval of a $2,000,000 power project which would furnish electricity to cities and rural areas of the entire Black Hills region was made recently in South Dakota at a meeting of officials from ten cities. The project would utilize the coal fields in the vicinity of Gillette, Wyo., for generating power. It would involve construction of a steam-generating plant and a system of transmission lines. Application for federal public works funds to finance the project is discussed. The system would be administered by a non-profit association made up of the several cities.

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Weld Testing Bureau

Functioning as a part of the Pittsburgh Testing Laboratory a National Weld Testing Bureau has been established in that city. This division will be headed by James W. Owens, consulting engineer. Services will include reports of welding processes to manufacturers, fabricators, contractors, etc; reports on weld specimens made prior to construction; reports on weld specimens made during construction; laboratory tests of weld specimens; inspection of welded products and structures, and investigations of special welding problems.

EDITORIALS

L.W.W.MORROW
Editor

What lies ahead in business?

STOCK MARKET readjustments and commodity price changes accentuate the interest in business prospects. At present there is a slight slackening in general business activity. Consumption of steel, carloadings, check payments, building contracts, money in circulation, bank loans—all these are stationary or decreasing. Only industrial power consumption continues to increase, indicating that mills and factories are continuing to step up production. In addition total electrical energy production is holding up well. Thus, despite the summer slackening that is to be expected, no very positive index exists to foretell the future. But a logical analysis of conditions indicates that the general business trend will be upward in the coming quarter. The effect of the government's vigorous campaign for increased purchasing power and rising prices will be supplemented by a powerful dose of inflation if necessary. No slump can be permitted if the recovery campaign is to be successful.

Undoubtedly expectation of inflation plays a large part in present business activity. Producers and distributors will expand their output and their buying so long as they expect rising prices, and this speculative element is active at present in causing business. This process can go on for a limited time only unless there is a corresponding increase in purchasing power, and the Administration, through the use of the blanket code, is endeavoring now to expand purchasing power rapidly. The test of the implied inflation policy will come late this fall and in the meantime business in all industry should continue to expand. The electrical industry, since it is responsive to all industry, should count upon increased business for the next three months at least. In addition, however, to waiting upon the effect of general business, the electrical industry should be aggressive in its selling, both to get its share of present opportunities and to aid in the recovery program.

A matter of importance to all power men

AS SKIES begin to clear and more wheels to turn in American industry there will be a great deal of work for the power salesmen of the country. For factory management will have a changed attitude toward economies in operation, and in every plant there will be changes to make to bring production into line with altered conditions in the marketplace. Prices are still low and as volume increases costs will have to be figured closer than in 1929.

This will demand much rearrangement of equipment and a new study of group and individual drive. Four years of deferred maintenance will have to be reckoned with. In a word, plant operations will have to be re-engineered to fit the times —electric motors, furnaces, control and lighting offering many possibilities for cutting costs.

When industrial activity returns this work will come with a rush, and it is not too soon to think about it now. For there is great need for preparatory work that will assist in the training of power salesmen and in the presentation of the case for electric power, heat and light, revised and recast in the form in which it will be needed.

There are not enough case studies available in a useful form to meet the variety of industries that will be interested, perhaps this fall, perhaps

a year from now. And in these industries much can be accomplished in advance, through promoting the discussion of these possibilities in the publication that these factory engineers read. It is a matter that deserves the early and earnest consideration of all power men.

New light on corona factors

THERE are a number of instances in macroscopic electrical phenomena which seem to approximate direct influence on individual ions. Examples are the wide range of resistance presented by a poor contact, the wide range of thermionic emission resulting from a narrow range of grid voltage, the sharp change in dielectric loss in insulation containing gas layers as the stress rises above a critical value, and finally, the wide variation of the corona-forming voltage and subsequent loss on transmission lines as related to exceedingly minute variations of conductor surface and atmospheric conditions.

The established certain laws of corona loss obtain only for such high values as to make the laws useless for ordinary engineering design relying primarily upon increment in loss occurring above critical or corona-forming voltage. The most important factors causing this uncertainty are the surface conditions of the line conductor, these in their turn as related to microscopic surface irregularities arising in manufacture, and further, the influence of weathering on these irregularities.

An interesting series of observations was recently reported by K. Potthoff in Elektrizitätswirtschaft in which it is shown that under some circumstances the influence of the surface condition is much greater than that of the diameter of the conductor itself, that there is a large decrease of loss with time due to weathering, and in general that the losses are less for aluminum than for copper conductors. Evidence is also given not only that the Peek law connecting loss and voltage is accurate for high values, a fact which has been often observed, but also that in the lower range the observed values of losses fall below those indicated by this law rather than above as often observed. No explanation of this latter fact is given, and it offers an interesting problem for further research as to the obscure nature of initial corona formation.

Radiated heat desirable

RECOGNITION is being given slowly to the radiation component in connection with space heating; particularly where air conditioning is contemplated is this recognition desirable. In England they went so far some time ago as to employ wallpaper with embedded filaments heated to low temperatures by electrical means. The intent in space heating for human comfort is primarily to maintain a thermal régime which will allow the body to dissipate its surplus heat at not much more or less than a normal rate. That is what makes for comfort, not just heating or cooling the room air so as to supply heat to or extract heat from the body by conduction.

Contrary to a common belief fostered by the Stefan-Boltzman fourth-power law for radiation and temperature, low temperature radiation does account for a large part of the dissipation from the human body. L. W. Chubb, director of Westinghouse research, recently told a Springfield audience that it accounts for 44 per cent of the 400 B.t.u. per hour released by an adult to keep his temperature normal. It seems perfectly logical to establish the thermal comfort differential through the same medium by which the emission takes place. Thus, if 44 per cent of the body heat is in the form of radiation, some such percentage of the heat supplied to the room in winter might well be of this form, and a corresponding cooling effect obtained in summer. Physiologically it is so effective that comfort is acknowledged even when the air temperature is as low as 50 deg. F. Economically, the virtue rests in cashing in on the coefficient of performance of the reversed refrigeration cycle. Four or five B.t.u. can be put into the walls in this way for each B.t.u. that would otherwise have to be put there in I^2R form.

Those who are skeptical about the efficacy of such a procedure which puts relatively little stress on heating the air of the room might give heed to their experiences with fireplaces. But not the roaring fireplace that singes your countenance while your back is denied any warmth. Surface heaters disposed strategically on the four walls and ceiling would give the effect of a multiplicity of mildly radiant fireplaces, invisible and lacking, perhaps, in the romantic appeal of dancing flames and entrancing embers, but rich in sound economic comfort.

Polyphase Meter Connections Checked by Timing Rotation

By A. F. NEWMAN and M. MINIKES

New York & Queens Electric Light & Power Company
Flushing, N. Y.

A COMPARATIVELY rapid and accurate "rotation" method of checking polyphase meter connections has been devised for installation where instrument transformers are used with the meter. This method has several advantages:

1. It can be applied at any time desired, since the consumer's service is not interrupted. This avoids the necessity of arranging to make a wiring check at a time convenient to the customer to shut down.

2. The check may be made during the consumer's full load period and a record of the actual load conditions obtained.

3. None of the meter wiring is disturbed; all temporary connections are made at the test switch. This avoids the danger, present in some other methods, of error in reconnecting wires temporarily opened.

4. Tester is not required to carry any large amount of testing equipment. This lightens his task and also eliminates the time needed to set up, connect and disconnect test apparatus.

5. It calls for no "ringing out" of conduit wiring.

6. Aside from its value as a connection check, the results when worked out form a valuable addition to the records of the meter department. A record of each consumer's load is obtained, showing power factor and phase balance. If further investigation is warranted, it is a simple matter to make several tests at various load conditions.

7. The information is secured much more quickly and cheaply than with graphic meters, power factor especially being difficult to obtain by graphic means.

8. The use of the results in determining peak currents is of great value in detecting overloaded meters. In many cases the consumer's maximum demand in kilowatts is well within the meter rating, but, due to low power factor, the current rating of the meter is being

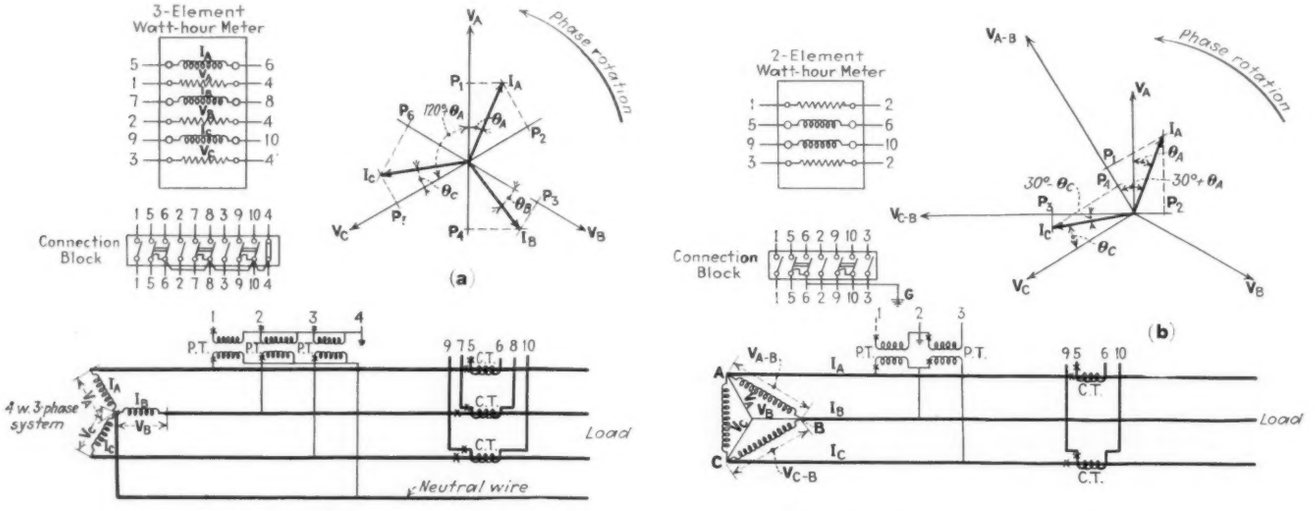


Fig. 1 a and b—Connections checked by vector analysis based on speed readings

(a) Three-element meter on four-wire load.

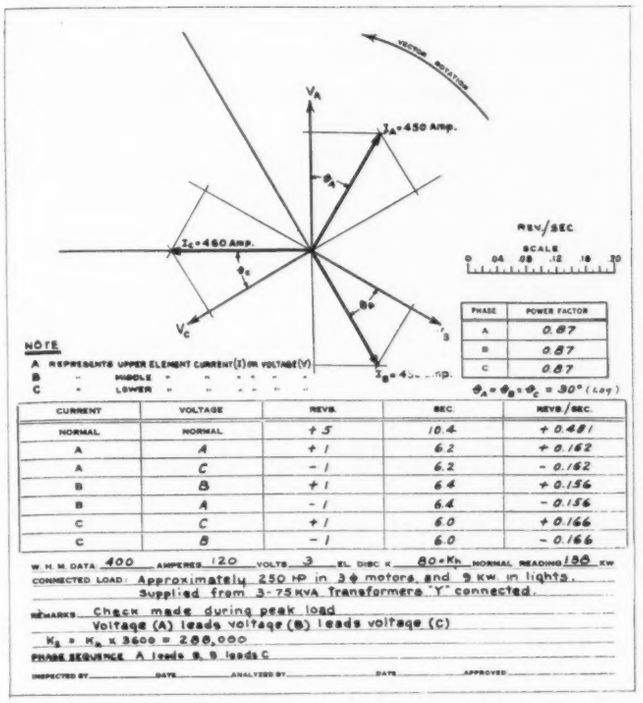
P_1 = Component of I_A in phase with V_A
P_2 = Component of I_A in phase with V_C
P_3 = Component of I_B in phase with V_B
P_4 = Component of I_B in phase with V_A
P_5 = Component of I_C in phase with V_C
P_6 = Component of I_C in phase with V_B
V_A = Voltage on upper element
V_B = Voltage on middle element
V_C = Voltage on lower element
I_A = Current in upper element
I_B = Current in middle element
I_C = Current in lower element
θ_A = Power factor angle upper element
θ_B = Power factor angle middleelement
θ_C = Power factor angle lower element

If the speed of the upper element alone is obtained, this speed represents the product $V_A I_A \cos \theta_A$, or, in other words, the product of the length V_A and the projected length of I_A on V_A, shown by P_1. If this is scaled in rev. per sec., its value is equivalent to $\frac{V_A I_A \cos \theta_A}{K_S}$ where K_S equals the value of each disk revolution in watt seconds and V_A and I_A are expressed in volts and amperes respectively.

(b) Two-element meter on three-wire load.

P_1 = Component of I_A in phase with V_{A-B}
P_2 = Component of I_A in phase with V_{C-B}
P_3 = Component of I_C in phase with V_{C-B}
P_4 = Component of I_C in phase with V_{A-B}
θ_A = P. F. angle, I_A with V_A
$(30° + \theta_A)$ = P.F. angle, on upper el.
θ_C = P.F. angle, I_C with V_C
$(30° - \theta_C)$ = P.F. angle, lower element
V_A = Equivalent phase to neutral voltage of A phase
V_B = Equivalent phase to neutral voltage of B phase
V_C = Equivalent phase to neutral voltage of C phase
V_{A-B} = Voltage on upper element
V_{C-B} = Voltage on lower element
I_A = Current in upper element
I_C = Current in lower element

Similarly, if the current I_A is used with the voltage V_C, the speed is again proportional to $V_C I_A \cos (120 \text{ deg.} + \theta_A)$, or, in other words, the product of the length V_C and the projected length of I_A on V_C shown by P_2. If scaled in rev. per sec. its value is equivalent to $\frac{V_A I_A \cos (120 \text{ deg.} + \theta_A)}{K_S}$. These values may be positive or negative.



CURRENT	VOLTAGE	REVS.	SEC.	REVS./SEC.
NORMAL	NORMAL	+ 5	10.4	+ 0.481
A	A	+ 1	6.2	+ 0.162
A	C	- 1	6.2	- 0.162
B	B	+ 1	6.4	+ 0.156
B	A	- 1	6.4	- 0.156
C	C	+ 1	6.0	+ 0.166
C	B	- 1	6.0	- 0.166

W. H. M. DATA 400 AMPERES 120 VOLTS 3 EL. DISC K 80 × K_h NORMAL READING 180 KW
CONNECTED LOAD: Approximately 250 HP in 3 ϕ motors and 9 KW. in lights.
Supplied from 3-75 KVA Transformers "Y" connected.
REMARKS: Check made during peak load
Voltage (A) leads voltage (B) leads voltage (C)
$K_s = K_h \times 3600 = 288{,}000$
PHASE SEQUENCE A leads B, B leads C
INSPECTED BY ____ DATE ____ ANALYZED BY ____ DATE ____ APPROVED ____

Fig. 2—Three-element meter connections verified

The vectors drawn from the test data are found consistent with the load conditions reported by the tester.

exceeded. The data obtained from a rotation check make such a condition evident. In a similar manner underloaded meters may be discovered.

Briefly, the procedure is to observe the meter rotation produced by the current in each current coil of the watt-hour meter, when taken with two of the voltages to the meter. The same fundamental principle has been used in the method of checking the correctness of watt-hour meter connections described in the National Electric Light Association meter committee bulletin, 278-31. The method described in the present article is a more simple application of the principles. It takes advantage of the fact that the speed of a watt-hour meter is directly proportional to the product of the voltage applied to the potential coil and the in-phase component of the current in the current coil of the element. See Fig. 1a.

Vector data obtained from speed readings

The rotation method uses the reverse process from that described in the N.E.L.A. bulletin as exemplified by Fig. 1. It avoids the necessity of using wattmeters and ammeters to obtain currents and phase angles. The torques or speeds produced by I_A with V_A and I_A with V_C are the quantities measured. If these quantities are laid off to scale in revolutions per second on the respective voltage vectors, V_A and V_C (positive or negative as the values may be), and perpendiculars are erected at these points, then the point of intersection of the perpendiculars marks the end of current vector I_A to some scale. Its magnitude is then proportional to its length. Its value in amperes = Rev./sec. $\times \frac{K_S}{V_A}$. Its phase relationship in the circuit is shown by its vector position.

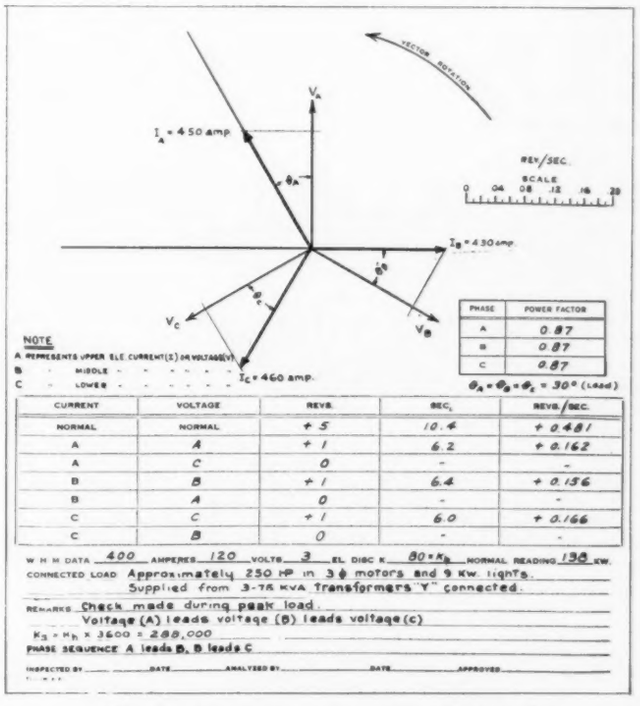
The other elements are treated in the same manner. In each case the speed produced by the current in that element is obtained with the voltage of that element, and then with the voltage of one other element. Results are plotted as above and the two other current vectors I_B and I_C are obtained as in Fig. 1a. The corresponding vector relations obtained for a two-element meter connected to a three-wire, three-phase system are shown in Fig. 1b. As for the three-element meter, the speeds produced by I_A with $V_{A\text{-}B}$ and I_A with $V_{C\text{-}B}$ are measured. These quantities are laid off to scale in revolutions per second on the respective voltage vectors, $V_{A\text{-}B}$ and $V_{C\text{-}B}$ (positive or negative as the values may be). Perpendiculars are erected as before and the point of intersection of these perpendiculars marks the end of current vector I_A.

The other element is treated in similar manner. Results are plotted as above and the other current vector I_C is obtained.

By analyzing the vector relations plotted against known conditions of load an accurate check is had of the correctness of the meter connections. It also provides an indication of the current and power-factor conditions in each phase.

Making the test in the field

The tester's equipment consists of a stop-watch, phase-sequence indicator, jumpers for making temporary connections and sheets for recording the results. All permanent meter installations are equipped with test switches, or test links, which provide a ready means of disconnecting the various meter circuits. The tester first observes the meter rotation to determine if the load is steady. Consistent results cannot be obtained with

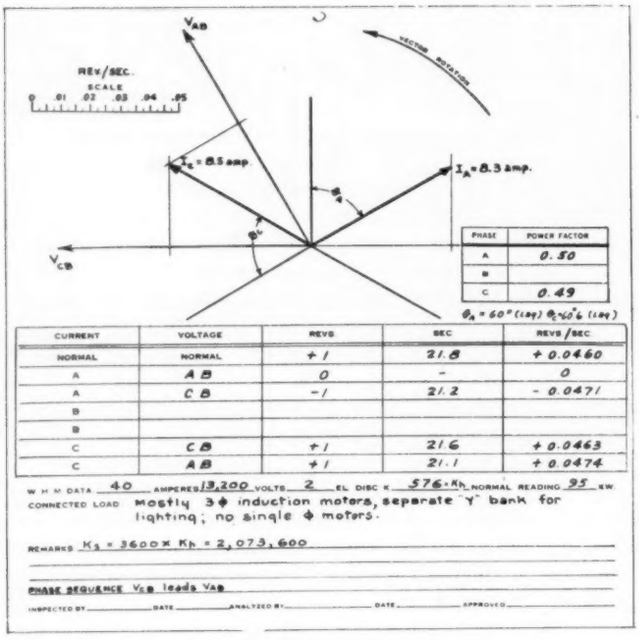


CURRENT	VOLTAGE	REVS.	SEC.	REVS./SEC.
NORMAL	NORMAL	+ 5	10.4	+ 0.481
A	A	+ 1	6.2	+ 0.162
A	C	0	-	-
B	B	+ 1	6.4	+ 0.156
B	A	0	-	-
C	C	+ 1	6.0	+ 0.166
C	B	0	-	-

W H M DATA 400 AMPERES 120 VOLTS 3 EL DISC K 80 × K_h NORMAL READING 198 KW.
CONNECTED LOAD Approximately 250 HP in 3 ϕ motors and 9 Kw. lights.
Supplied from 3-75 KVA transformers "Y" connected.
REMARKS Check made during peak load
Voltage (A) leads voltage (B) leads voltage (C)
$K_S = K_h \times 3600 = 288{,}000$
PHASE SEQUENCE A leads B, B leads C
INSPECTED BY ____ DATE ____ ANALYZED BY ____ DATE ____ APPROVED ____

Fig. 3—Incorrect connections disclosed

Check shows the four-wire, three-element meter has all current elements reversed and each associated with the advanced phase voltage. This is inferred as follows: Evidently each current should lag rather than lead its voltage under the recorded load conditions. This would result in the vector diagram if all three currents were reversed and associated with the phase voltages 120 deg. behind their present voltages.



CURRENT	VOLTAGE	REVS	SEC	REVS/SEC
NORMAL	NORMAL	+1	21.8	+0.0460
A	AB	0	-	0
A	CB	-1	21.2	-0.0471
B				
B				
C	CB	+1	21.6	+0.0463
C	AB	+1	21.1	+0.0474

W. H. M. DATA 40 AMPERES 13,200 VOLTS 2 EL. DISC K 576·K_h NORMAL READING 95 KW.
CONNECTED LOAD: Mostly 3φ induction motors, separate "Y" bank for lighting; no single φ motors.
REMARKS K_s = 3600 × K_h = 2,073,600
PHASE SEQUENCE V_{CB} leads V_{AB}
INSPECTED BY ____ DATE ____ ANALYZED BY ____ DATE ____ APPROVED ____

Fig. 4—Two-element connections found to be correct

Here the vectors are consistent with the load conditions.

unsteady load. Then he takes a "normal" reading; i.e., he times the meter disk with connections undisturbed. This reading will give the consumer's load at the time of check.

The next step is to observe the rotation of the meter disk when acted upon by one element at a time. To do this, all current test switches, except one, are short circuited. The tester obtains the time for some convenient number of revolutions, using the stop-watch. He then rearranges the switches to obtain the reading of the next element, and so on. The tester next obtains cross-phase combinations:

Taking I_A and V_C of Fig. 1a as an example, he opens A phase potential switch and all the current switches except I_A. By means of a jumper, he applies V_C to the potential coil of the A phase element. The rotation is timed, as before. The tester continues in this manner until he has at least two readings for each current, one with potential of the same phase and one with a different element potential.

The tester assumes A phase current and A phase potential to represent the current and voltage applied to the upper element, B phase to apply to the middle element and C phase to apply to the lower element, and enters results accordingly. Actually what appears to be phase current A at the connection block may be phase B at C current. He ignores this possibility in recording his data. Subsequent vector diagram analysis reveals whether the assumption was right or wrong. See Fig. 3 for an example.

He then obtains the phase sequence at the connection block or at the meter, assuming A phase to represent the voltage on the upper element, B phase on the middle element and C phase on the lower element.

Data on character of load required

It is necessary to obtain some data on the connected load. The tester observes whether the installation is chiefly lighting or power, whether the motors are induction or synchronous, single phase or polyphase and he notes any special apparatus, such as induction furnaces or arc-welding sets. This information is made as complete as possible; it proves of value in interpreting the results.

The tester enters the results obtained on a printed form, as in Figs. 2 to 5. After filling out the heading, the columns "Current," "Voltage," "Rev." and "Sec." are entered from the stop-watch readings. The phase sequence is then recorded in the space provided for it on the form. Under "Connected Load" information is supplied about the consumer's load in actual use at the time of check. The sheet is then ready for office analysis.

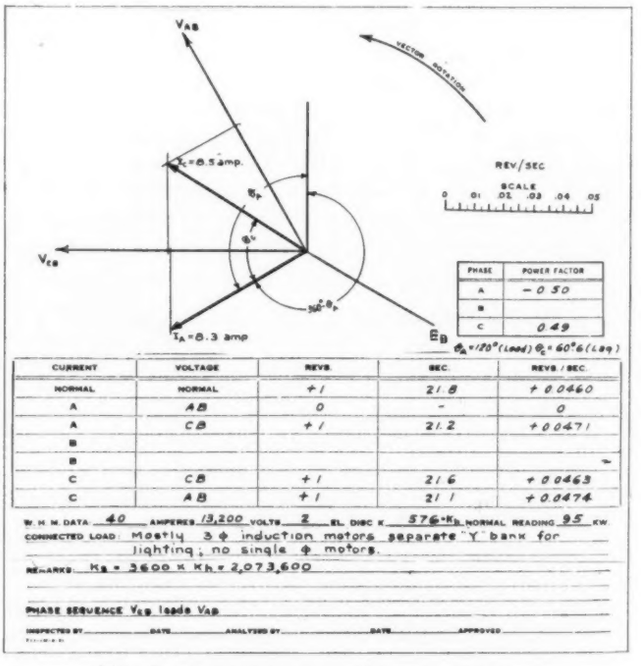
Analyzing the results at the office

The printed form carries a diagram, showing the voltage vectors for both a three-element, three-phase, four-wire meter and a two-element, three-phase, three-wire meter. Use is made of only that set of vectors applying to the check made. First the "Rev./Sec." column is computed. Care should be taken to indicate whether this is positive or negative. The phase sequence is then indicated by an arrow head on the vector diagram. Then a convenient scale is adopted for representing revolutions per second and the rotations laid off along the corresponding voltage vectors. (A backward rotation is plotted along the voltage vector reversed.) For example, the rotation due to I_A V_A of Fig. 2 is laid off along V_A; that due to $I_A V_C$ is plotted along V_C reversed. Perpendiculars are then erected and a vector is obtained whose direction is that of I_A. This vector is labeled I_A. Similarly the other current vectors are plotted.

Bearing in mind that the current scale is K_S times the Rev./Sec. scale, the phase current may be scaled off from the diagram. The power factor also is obtained directly from the diagram. In practice, the value used for V is the nominal system voltage.

Detection of wrong connections is made from a study of the vector diagram. Since almost all loads are at least approximately balanced, the current vectors should be nearly equal in magnitude and in phase angle. Any marked unbalance requires investigation. Of course the load may be unbalanced, and in such a case the information obtained by the tester is valuable in analyzing the condition. A defective transformer may be discovered in this manner.

If one current coil of the meter is reversed the current vector will fall 180 deg. from the expected position. This reversal is readily detected. If one potential coil is reversed it will reverse one component of any current



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B				
C	CB	+1	21.6	+0.0463
C	AB	+1	21.1	+0.0474

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REMARKS K_s = 3600 × K_h = 2,073,600
PHASE SEQUENCE V_{CB} leads V_{AB}
INSPECTED BY ____ DATE ____ ANALYZED BY ____ DATE ____ APPROVED ____

Fig. 5—Improper two-element meter connections revealed

Check shows the current element in one phase (A) reversed. The prevailing 50 per cent power-factor load results in practically zero torque in the upper element. If the power factor should improve the torque in this element under the incorrect connections disclosed would become negative and lead to serious errors in energy registration.

timed with this voltage. Assuming the load itself is balanced, this will give current vectors unbalanced both in magnitude and phase angle.

It is beyond the scope of this paper to analyze all the possible conditions that may be encountered. Three examples are afforded by Figs. 2 to 5 which illustrate the general method of procedure. To any one familiar with the theory of polyphase alternating currents interpretation of the results should offer no difficulty.

If the meter is equipped with some device for recording the maximum demand in kilowatts, we may use the results of the rotation check to compute the maximum current taken by the consumer. This is done by dividing the peak kw., from the demand meter, by the power factor found on the rotation test. This gives the peak kva., which is readily reduced to amperes. This involves the assumption that the power factor found on the rotation check is the same as that during peak conditions.

An analysis of the vector relations in the two typical incorrect connections shown in Figs. 3 and 5 show a leading power factor on the elements incorrectly connected, which is obviously inconsistent with the existing load conditions at the time of check. The leading power factor shown exists only at the watt-hour meter due to the incorrect combination of the currents and voltages resulting from the incorrect connection. For correct connection the vectors obtained should coincide with actual loading condition as in Figs. 2 and 4.

The examples illustrated in these figures are given because the most common method of checking the correctness of connections of a polyphase meter in service is to operate each element separately and then note direction and speed of rotation. With the incorrect connections shown in Figs. 3 and 5, operating each element separately will give almost the same element speed and direction of rotation as with the correct connections of Figs. 2 and 4. The rotation method, however, shows the incorrect connection clearly.

▼ ▼ ▼

Where Did It Go?

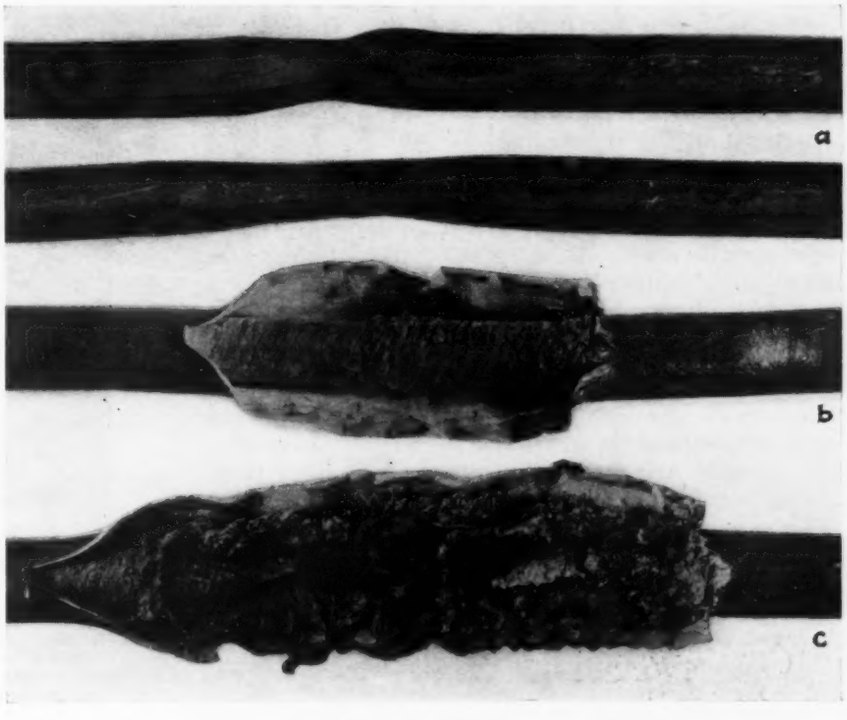
Can a 2½-in. section of No. 4/0 copper conductor fuse inside a single-conductor, lead-covered cable and completely disappear without rupturing the insulation or lead sheath? While it seems impossible, it did nevertheless occur during tests to determine the clearing qualities of a new type of secondary network cable when subjected to short-circuit conditions, according to reports from the Rockbestos Products Corporation, for which the tests* were conducted by the Western Massachusetts Companies at East Springfield, Mass.

The particular test in which this phenomenon occurred involved three No. 4/0 single-conductor, lead-covered cables and the same size bare neutral, which had been short circuited at the centers before subjecting to 6,000 amp. (total) per phase (fed from both ends). The ducts and manholes in which these cables were laid were submerged in water. Phases B and C cleared after eight minutes 44 seconds and ten minutes 12 seconds respectively, but due to the high rate of heat dissipation phase A cable had not cleared after fourteen minutes 18 seconds, when the test was discontinued to protect the test transformers.

In coiling up the cables after their removal from the du ts it was observed that B and C phase cables had a tendency to bend sharply at two or three places along their length, although the lead sheath was intact. The sheath was cut away to expose the insulation, which was also found intact. Removal of the insulation showed that the conductor had burned clear, leaving a gap of 2½ in.

Apparently the copper, upon fusing, flowed back into the space created by the melting of the stranded conductor on each side of this gap, the company suggests. The fact that the lead sheath remained intact, it adds, may be accounted for by the presence of the surrounding water and the small amount of gas given off by the insulation.

A brief account of these tests was published on page 406 of the April 1 issue of ELECTRICAL WORLD, *but the phenomenon observed above was just recently announced by the manufacturer.*



Section of cable in which 2½ in. of No. 4/0 conductor disappeared

(a) Exterior of two sections of cable before dissection. Note lead sheath is intact and constricted, not bulged. (b) Lead sheath cut open showing insulation intact except where slightly damaged by handling after exposure. (c) Insulation cut away showing 2½-in. gap where conductor fused.

Fault Currents Low With Heavy Power Capacity

By H. W. PAPST
Switchboard Engineer,
Westinghouse Electric & Manufacturing Company

PREDETERMINATION of possible short circuits or low-voltage, heavy-current circuits cannot safely be made by applying the rules that give reliable predictions for high-voltage circuits where arcs are of a sustained character. If this difference is not observed needless expense for overprotection and re-enforcement will be incurred with the increasing use of high-capacity, low-voltage a.c. networks. It is also essential that conductors to carry heavy continuous alternating currents be carefully designed in order to secure the desired capacity regardless of machine design.

To establish the maximum necessary protective requirements of circuit breakers against possible short circuits on 220-440 volt a.c. circuits only two conditions need be considered:

1. The very improbable cases where high-pressure, low-resistance fault contacts may be established.

2. Accidental faults such as those which may occur during maintenance operations, the misplacement or dropping of a tool between conductors, metallic penetration of power cables or wire short circuits between phases of a conductor.

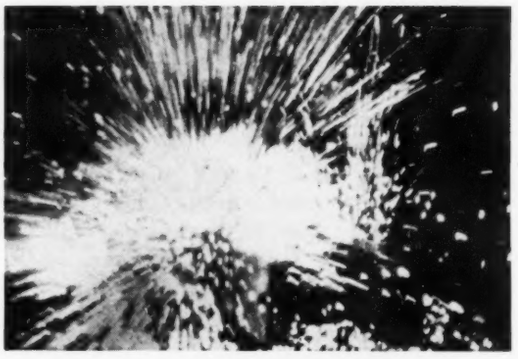
Fault small fraction of feed-in capacity

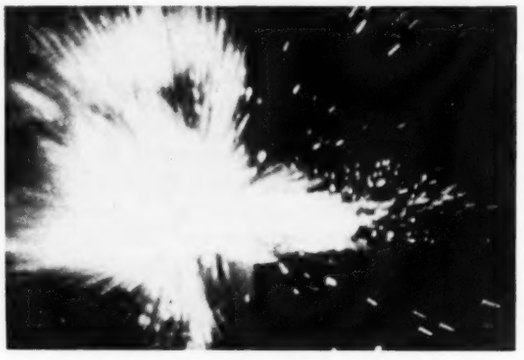
Laboratory investigations as well as extensive experience show that although generator and transformer capacity combined on a 220 or 440 volt a.c. bus may exceed a hundred thousand short-circuit amperes, actual fault currents will be a very small fraction of this amount. If a fault of 20,000 amp. is assumed on a 440-volt bus the double fault contact resistance cannot exceed 0.022 ohm. Magnetic forces at such current values and in the confined space of the short-circuit arc are very appreciable and in most cases are sufficient to separate the conductors and blow out the arc in less than half a cycle. With separation of the conductors arcs are seldom re-established unless the conductors can fall back into metallic contact.

Main bus breakers for circuits having large power supplies necessarily must be physically large to handle their normal current rating. On account of their size and in order to meet their usual operating requirements their rupturing capacity inherently meets the very improbable rupturing requirements of condition (1) above.

Small breakers adequate for the branches

Branch circuits with smaller current demands require much smaller breakers which, due to their size, have relatively smaller rupturing capacities. However, these smaller breakers, meeting the requirements of condition (2) above are adequate for all branch circuit protection. Additional expense to obtain increased rupturing capacity is not justified. Of equal importance with rupturing capacity in the design of these small breakers is their ability to withstand many operations, either manual or automatic, and to be free from excessive heating or burning of their contacts.





Figs. 1 and 2—Faults spectacular but mild in effect

Two channels forming the conductors of a single-phase bus were connected with short leads to the transformer low-voltage terminals. The short was formed with a heavy copper bar hinged to one channel and solidly connected to it with a flexible shunt. It was weighted down in contact with the other channel or return conductor by a 30-lb. weight. Fig. 1, copper to aluminum fault, and Fig. 2, copper to copper. Both faults reached approximately the same current magnitude and cleared in half a cycle to re-establish several cycles later on metallic contact and repeat the operation until the power was cut off.

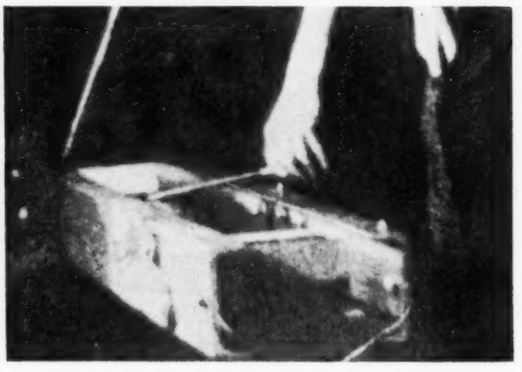


Fig. 3—What would happen if a screwdriver were dropped on a high-capacity, low-voltage bus?

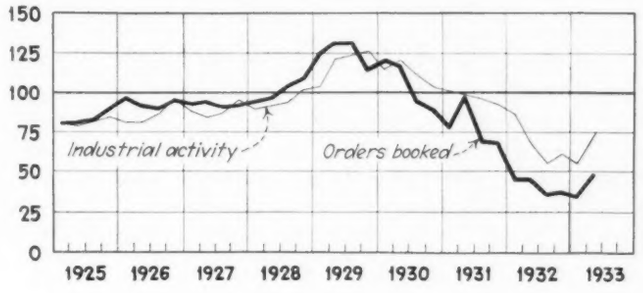
Close examination of the nearer channel in Fig. 3 reveals a relatively small amount of damage as a result of a series of about forty short circuits similar to those shown in Figs. 1 and 2. The screwdriver points to the place of burning.

Tests have verified that short-circuit currents on low-voltage a.c. circuits are reduced from what would be expected from the usual calculations. The short circuits were made on a heavy current bus on the secondary side of a 3,000-kva., low-reactance transformer. The power supply was from a nearby 20,000-kva. generator. The circuit had an actual short circuit V/2 capacity of 200,000 r.m.s. amp. Under numerous set-ups representative of condition (1) the maximum short-circuit current obtained was 68,000 r.m.s. amp. The circuit voltage was 300.

Dropping a screwdriver on the bus, Fig. 3, resulted in a peak current on actual test of 24,000 amp. which extinguished in less than a quarter cycle, or before the natural peak of the current wave. The screwdriver was blown clear by the magnetic blowout force. For another test a 5,684-circ.mil copper wire solidly shorted on the bus fused and broke the current at 17,200 amp.

▼

Electrical Orders Up; Production Too



Increased orders and increased industrial activity in the second quarter of 1933 are indicated in the accompanying chart relating to the electrical manufacturing industry. After falling to the record minimum in the first quarter orders turned sharply upward.

Normally, as will be evident from the chart, there is a time lag between orders and productive activity. In this particular instance the orders curve did not forecast the turn in the other. Conditions changed so rapidly that production was stepped up with very little delay.

The line marked "Industrial Activity" shows the quarterly average of the ELECTRICAL WORLD'S monthly index for this particular industry, based on reports of energy consumption. The other line is based on dollar values of orders booked as announced by the Bureau of the Census. Both sets of data have been recomputed to a common base—the quarterly average for the five-year period 1926-1930.

Since the ELECTRICAL WORLD index measures volume, it was necessary to take into account the changes in price that occurred during the period under consideration so that the curves might be comparable. This was done by applying the Bureau of Labor Statistics index of wholesale prices in the metal products industry to the dollar values for the respective quarters, thus converting them to relative volumes as nearly as could be done in the light of available data.

Detector Locates Low-Resistance Open Faults

By S. MATSUDA

Osaka Municipal Electric Bureau, Osaka, Japan

Among several types of cable failures, "opens" with low resistance to ground are the most difficult ones to locate. A new adaptation of the conventional Wheatstone bridge detector has been devised for use on the system of Osaka City. The apparatus is simple, composed of familiar units and involves no intricate calculations. Faults on lengths of several kilometers can be located with a high degree of accuracy. It has proved superior to some form of interrupted high frequency picked up by an exploring coil. These have at best been uncertain and have proved unsatisfactory except under favorable circumstances.

For this type of fault the usual bridge detector is supplemented by an independent adjustable resistance connected to ground in parallel with the capacitance of the good conductor. Opens having as low as a few hundred ohms across the open conductor to ground have been located quite successfully. If the resistance is very low it is necessary to adjust the auxiliary resistance to low value in balancing. The method involves a telephone receiver and an alternating or pulsating current (an ordinary buzzer will answer the purpose); the object is to compare the capacity of the open conductor, from the point of test to the open, with the capacity of the good conductor of known length. It differs, however, from the usual method by compensating the disturbing effect upon the measurement due to the ground resistance of the faulty conductor by inserting the adjustable resistance in parallel with it.

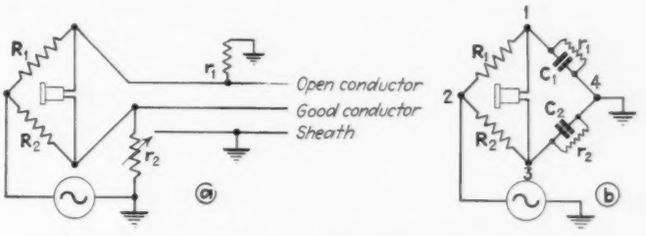
Thus, if in the figure the capacities C_1 and C_2 are the capacities of an open conductor and a good conductor, respectively, these two capacities can be balanced against R_1 and R_2 in the other two arms of the bridge by adjusting the variable resistor r_2 and the ratio arms alternately until the point of minimum sound is reached. Then the points 1 and 3 are at the same potential and, taking the conductor capacities as proportional to their respective lengths, those lengths are in the inverse ratio of the ratio arm resistance.

Analysis of the bridge circuit shows that for balance

(1) the power factor of the two capacitive arms must be the same.

(2) the ratios of X (and of $1/C$) to r must be the same.

(3) the R values are inversely proportional to the capacitances in the capacitive arms consisting of the cable conductors.



Supplementary resistance aids Wheatstone bridge in locating low resistance open faults in power cables

Italian Observations on Electric Railroad Operation

ANALYSIS of operating costs with steam and electric traction on the Italian State Railways leads to the following general conclusions, according to G. Bianchi, who addressed the World Power Conference in Stockholm July 3:

(a) In countries like Italy, not supplied with coal but rich in hydraulic power, the total cost for a given number of steam locomotives (superintending staff and engineers, fuel, lubricants, water, maintenance as well as sinking fund) seems to be higher than a corresponding total cost of an equal number of electric locomotives (superintending staff and engineers, power, lubricants, maintenance, interest and sinking fund) even when coal drops to the lowest prices and electric power is charged on a comparatively high rate.

(b) The difference between the aforesaid cost of steam and electric locomotives covers the expenses for contact lines and substations (staff, maintenance, interest and sinking fund) in greater or smaller proportion, according to importance of traffic.

(c) For steam traction the only important economy which may be realized with technical advance concerns expenses for fuel, while other items of expense (staff, maintenance, interest on capital) may be reduced only by a very moderate amount.

(d) For electric traction the problem of effecting economies can be examined from several points of view.

First, we observe that for lines with electric traction having a traffic exceeding 4,000,000 tons yearly the operating costs of locomotives are considerably greater than the expenses of fixed installations (lines and substations). We can therefore realize the best economy in the item of locomotives.

Staff expenses can be reduced by using only one engineer instead of two, and because electric locomotives require less call than steam engines.

The expenses of maintenance can be reduced by making a standard type of locomotive (already adopted for locomotives at 3,000 volts d.c. on the Italian State Railways) and concentrating the repairs to a few specialized workshops.

Capital costs can be decreased by reducing as much as possible the number of electric locomotives required for a certain service. Such reduction is possible because of the longer runs between repairs for electric comparison with steam locomotives (2 or 3:1) because of the less care required for electric locomotives and because of the possibility of establishing turns of service for the locomotives, independent of the turns established for staff.

As to the fixed installations, economies may be obtained by adopting the simplest kinds of contact lines and substations and by reducing to a minimum the staff charged with maintenance.

Finally, the cost of electric power can be decreased by using the same installations (power plants and transmission lines) as employed for the production and transmission for other industrial purposes.

In substantiation of these statements the speaker presented considerable data covering the nineteen-year period from 1913-1931, some of which are reproduced herewith. However, he pointed out that an exact comparison cannot be made between the two systems because of difference in operating conditions. The electrified trackage represents only 12 per cent of that operated by steam, but the traffic on the former in 1931 constituted 26 per cent of the steam traffic, indicating more than twice the average density of the steam lines.

First, he compares the unit operating costs of the steam and electric locomotives, without including the fixed and operating charges on the transmission lines, contact system and substations. In the operating costs are included the wages of the locomotive crew, superintending and repair shop staff, power (or fuel and water) and lubricants as well as maintenance costs, interest and upkeep on the locomotives. The fluctuations in price of coal and electric power are shown, because they constitute large items in the cost of operation. Comparison of the unit repair costs for locomotives of both systems are then presented. Finally, the total operating costs of both systems are compared, including the fixed and operating costs of the transmission lines, contact system and substations, which the author calls the fixed installation. Expenses on the latter include staff, maintenance, renewals and interest on the capital invested in the transmission lines, contact system and substations.

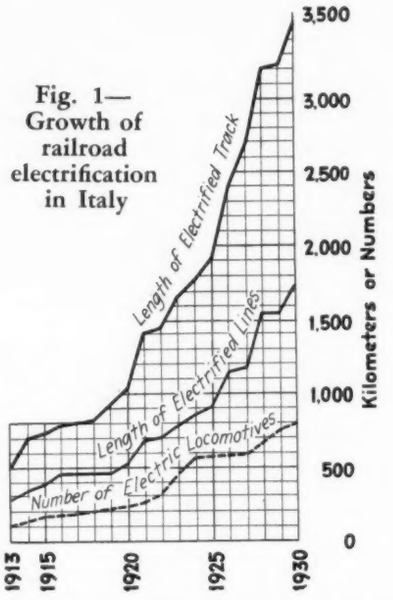


Fig. 1—Growth of railroad electrification in Italy

The extraordinary variations in the unit operating cost for steam traction result chiefly from the great fluctuations in coal rates, while the increase in unit costs of electric locomotives is only partly due to the continually rising cost of electric power and largely caused by the

Magnitude of Various Items in Costs of Steam and Electric Traction

Item of Costs	Steam	Electric	
	Per Cent		
Superintendence and driving	30.5	17.1	
Fuel	29.0	....	
Electric energy	....	21.0	
Water	0.5	....	62.2
Lubricants	0.7	0.3	
Maintenance of locomotives	25.0	11.0	
Renewals of locomotives	2.2	1.8	
Interest on capital invested in locomotives	12.1	11.0	
Staff for the fixed installations* of electrification	....	13.1	
Maintenance of fixed installations* of electrification	....	3.6	
Renewals of the fixed installations* of electrification	....	1.1	37.8
Interest on the capital of the fixed installations* of electrification	....	20.0	
Full amount	100.0	100.0	

*Transmission, contact lines and substations.

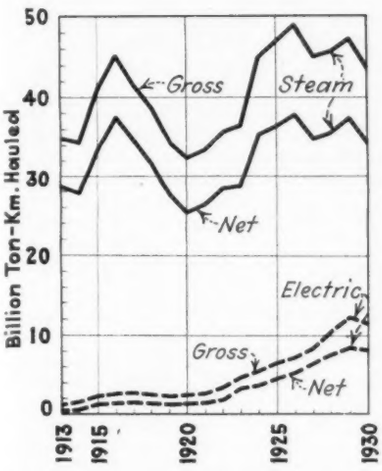


Fig. 2—Ton-km. hauled by steam and electric locomotives

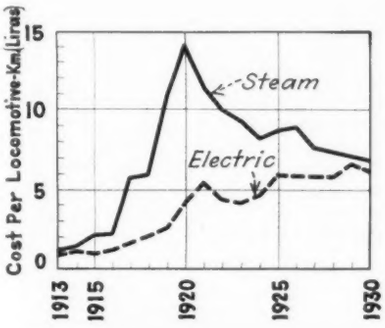


Fig. 3—Operating expenses per locomotive-km.
Refers to locomotive expenses only

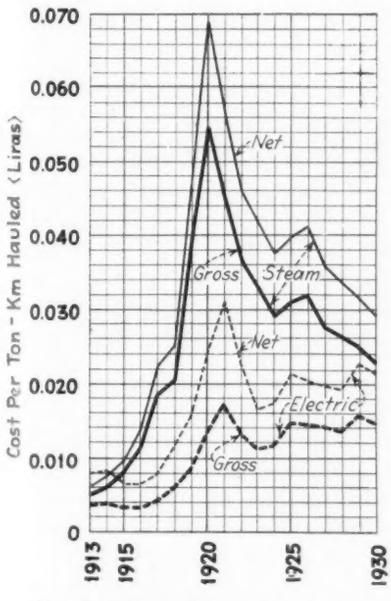


Fig. 4—Operating expenses per ton-km. hauled
Refers to locomotive expenses only

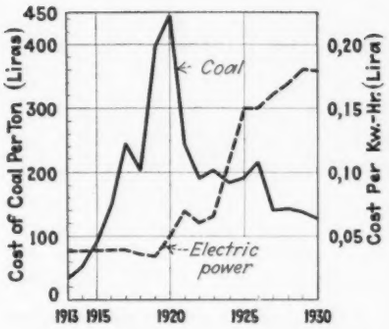


Fig. 5—Fluctuations in cost of coal and power

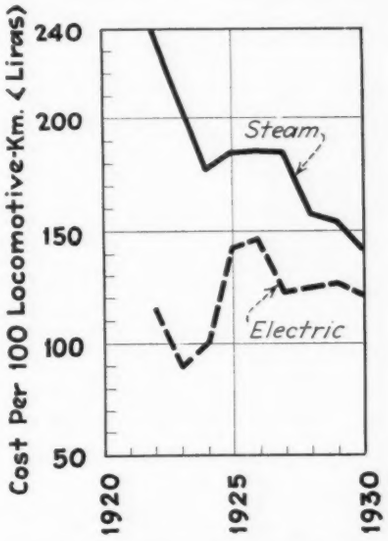


Fig. 6—Cost of repairs per 100 locomotive-km.
Refers to locomotive repairs only

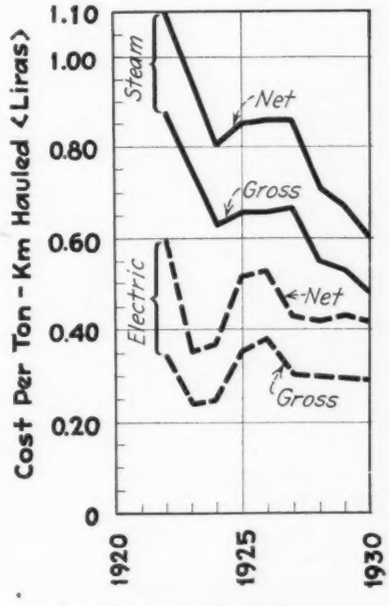


Fig. 7—Cost of repairs per 100 ton-km. hauled
Refers to locomotive repairs only

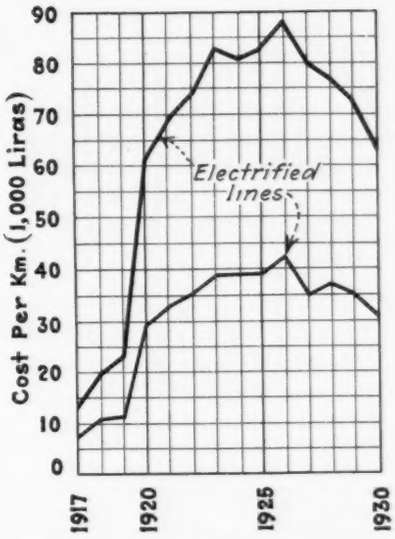


Fig. 8 — Unit-operating costs of transmission lines, contact system and substations

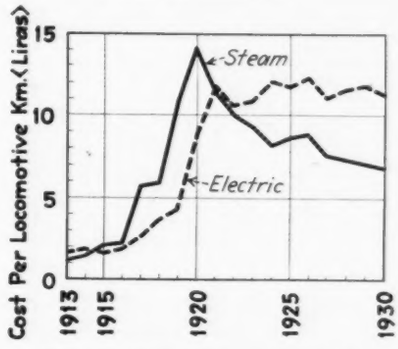


Fig. 9—Total operating cost per locomotive-km.
Includes operating and fixed charges on transmission lines, contact system and substations.

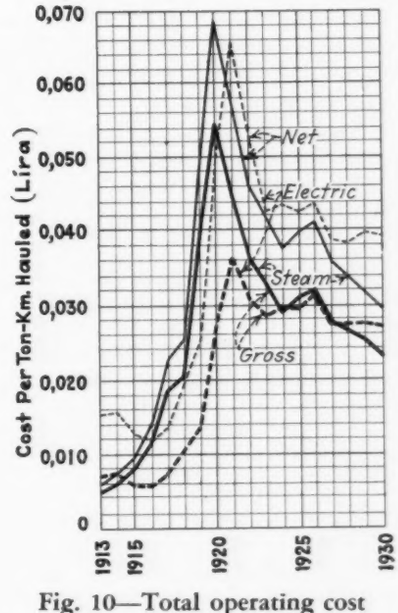


Fig. 10—Total operating cost per ton-km. hauled
Includes operating and fixed charges on transmission lines, contact system and substations.

excess supply of electric locomotives with respect to traffic demands. In 1932 about 25 per cent of the electric locomotives on hand were not in use, due to smaller traffic needs than anticipated when the units were purchased, and more were used than required.

Reduction in operating cost of the fixed electrical installation during recent years was due chiefly to a reduction of staff on contact lines and at substations.

Despite the rapid drop in the cost of coal after 1921, it may be noted that the total cost of electric operation per ton-km. (gross) was less than the unit cost for steam traction up to 1928, and the average total operating cost of electrified lines was not higher than that for steam lines during the ten-year period from 1913-1932.

Commenting on the data presented Mr. Bianchi says:

Economy in staff expenses, having as yet been realized only to a small extent, may be obtained by requiring only one engineer instead of two for running the locomotive. The use of two engineers is a tradition of steam traction rather than a real requirement for operating electric locomotives.

In order to obtain such economy without imperiling safety requirements (many of the ideas that still survive in railway transportation have no weight in more modern ways of conveyance) various automatic appliances have been invented of late for stopping the train in case of emergency—illness or absence of the driver—and the regulations for the future can be made even more logical than those now on hand.

The items of upkeep and interest on capital invested in electric locomotives can be considerably reduced, since a smaller number of electric locomotives is required compared with the corresponding necessary number of steam locomotives.

Such reduction is possible because electric locomotives make longer runs without requiring repairs (usually the proportion is 2 or 3 to 1). There is, further, less daily interruptions in the electric service (usually the electric locomotives need not be sent to depot for several consecutive days). Finally, the service periods of the electric locomotives can be made independent of those of the staff. In some cases we have found that the number of electric locomotives can be reduced to one-third the number of steam locomotives for the same service.

If we bear in mind the 25 per cent of the locomotives stored and not employed, we can lower the curves for costs of electric locomotives appearing in the diagrams. However, a fairer reduction would eliminate more than 15 per cent of costs (capital invested, interests and renewals), if the number of electric locomotives were limited to those that could be employed intensively to fullest capacity. This possibility has scarcely been exploited.

Even more substantial economy may be effected in the maintenance costs by standardizing the types and concentrating the heavy repairs to a few workshops. In examination of costs incurred in repairing 3,000-volt d.c. locomotives, with electrical and mechanical apparatus completely standardized, as compared with costs of repair operations of the same number of similar locomotives with non-standardized electrical and mechanical parts, we discover a possibility of reducing maintenance costs by more than 25 per cent by use of standardized locomotives.

As for the cost of the electricity produced by hydraulic power plants, this cost is not dependent on the sharp and unforeseen fluctuations that have taken place in the price of fuel. On the contrary, the cost can be exactly determined for a great many years to come.

The cost of power for electric traction can be decreased by combining such power plants for traction with plants already in use for other industrial purposes, so that we may effect a compensation between the price of the power for other uses and the price of the power for traction—a price that must be lowered as much as possible. The operating costs of the high-tension lines, contact lines and substations can be considerably decreased not only through the staff but principally by establishment of substations and contact lines with greater simplicity and economy.

The study we have already made of the operating costs for 3,000-volt d.c. substations and contact lines has demonstrated, for instance, the possibility of reducing such costs by more than 50% in comparison with those involved in electric lines of three-phase system, which, as we know, requires more substations and a far more complicated contact line.

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Analyzing Plans for Bulk Supply of Energy

In the delivery of electrical energy to a utility system a straight line is not always the shortest economic distance from the point of supply to the receiving buses. The importance of considering various alternative methods of supply was brought out not long since in an Eastern commission case where five plans were examined for a period extending seven years into the future. The distributing company had a reliable but rapidly aging steam generating station in which the estimated total cost of producing energy ranged from 2.23 cents per kilowatt-hour at the start of the period to 1.95 cents at its end. The plant was maintained ready for instant service at the outset of the inquiry, but was used little except on severe peaks. Most of the energy was purchased from an affiliated wholesaling company supplied from a modern steam turbine plant, the cost of electricity to the purchasing company being 1.63 cents per kilowatt-hour at the time of the study.

The engineering analysis showed that by retaining the distributing company's plant as a "cold" station only the wholesaler could sell at a rate of 1.395 cents per kilowatt-hour at the time of the investigation. This rate, it was ascertained, would probably drop to 1.21 cents at the end of the period, the downward trend being steady from year to year. Had the plan of maintaining a "hot" station been continued the cost of energy to the distributing company would have fallen only to 1.39 cents at the end of the seven years. The service record was reliable enough to permit the "cold" station plan to be adopted, and an agreement was made on this basis.

An interesting feature of the problem was the presence of a large retailing power company in the neighborhood. It was found that if the distributing company should buy energy from this utility at one substation the cost per kilowatt-hour would start at 2.273 cents and end at 1.785 cents when the period expired. If the energy was bought at another substation of the retailing utility the cost would have ranged from 1.675 cents to 1.428 cents. The difference was largely due to the second substation being nearer in transmission distance to the receiving company, but the lowest cost of all was derived from purchasing energy from the affiliated wholesaling company, which generated part of its output in a modern tidewater station and purchased the balance from an interconnected distant station of the large retailer above mentioned.

Thus, some of the energy supplied in the most economical set-up came from a great distance and some from a nearby station. The evidence presented in the case showed the importance of taking into account not only distances between substations and generating plants in figuring costs and contract prices, but also initial and later cable installation costs, effect of growing loads on the original plant investments, types of equipment and costs thereof and the varied possibilities of combining loads and facilities through interconnection aimed to realize maximum regional economy of energy supply.

How Central Hudson Builds Load Through Dealers

The story of a five-year experience in which the power company first merchandised aggressively, then gradually withdrew and built up dealer sales.

By EARL WHITEHORNE

POUGHKEEPSIE has been experimenting with appliance merchandising for four years. The Central Hudson Gas & Electric Corporation has been trying out a theory and a lot of electrical men have been watching and wondering whether it would work. Because it affects so many communities, this experience is on a sufficient scale to make it mean something, and time enough has passed to give it a test. It is important to the power industry also because no other city has gone so far in the effort to build up independent retailers of household appliances as creators of domestic load. And what they have learned is a valuable contribution toward solving the besetting problem of trade relations. The fact that the Central Hudson policy has come out of a background of intense merchandising activity makes the story the more worth studying.

It was in 1927 that the Central Hudson Gas & Electric Corporation was organized by the consolidation of a number of small utility companies in the Hudson River Valley. The principal communities served by the present system are Poughkeepsie, Newburgh, Kingston, Beacon, Saugerties and Catskill. The entire territory embraces some 2,500 square miles and a population of 250,500. The larger towns range from 12,000 to 40,300 in size and lie along the river, with a rich farming country to draw on. The territory was well covered with power lines. The problem of the new management, therefore, was to develop increased use of electricity and gas by existing customers. Because the valley towns are old and conservative, it looked like a job that the management would have to do itself, for a survey was made of all possible outlets for the sale of household labor-saving equipment and there were not enough progressive dealers and contractors to offer much hope.

First merchandising activity

So the company went to work and organized for a complete operation. It hired and trained salesmen, set up installation and service departments, developed an advertising program with an elaborate window display service and arranged for the financing of installment sales. It went at it thoroughly and intelligently, built up a wide coverage of the territory and a large volume of business in electric appliances, and did so good a selling job that many of the desirable dealers talked to about taking on the sale of appliances hesitated to enter the field.

Territory served by Central Hudson Gas & Electric Corporation

embraces 2,500 square miles with a population of 250,500, extending along the Hudson River, centering on Newburgh, Poughkeepsie and Kingston

This was of interest because the company from the beginning had a strong conviction that the ultimate distribution of this household equipment could best be handled through the many strong dealers, scattered about the section, who were already supplying the other needs of these homes. It believed that a well co-ordinated group of dealers serving all the communities would eventually be able to sell more merchandise and do it better than the power company could itself. And this objective was in mind even in the early planning. The management said this on numerous occasions, but nobody believed it.

The first step in this direction was taken in co-operation with the Hudson Valley League, which had been organized in 1923 with a string of local chapters in the major towns. This was a contractor group, interested primarily in wiring. It got the "red seal plan" going, to improve the adequacy of installations, and

sweetened up local industry co-operation and tried to interest the contractors in doing a better appliance selling job also. But little headway was made along that line. Some of the contractor-dealers, though they had sold few appliances in the past, were now complaining because the power company was getting all the business, despite the evidence that the activities of the utility had increased the popularity of the merchandise and stirred up more business for the dealers than they had had before. But the fact remained that dealer interest and participation was not growing enough to show progress.

First co-operation plan

This was in 1928 and the gas appliance business had not come along very well. Only the gas water heater was paying the bare cost of merchandising and the question of quitting the sale of gas appliances entirely was under consideration. But before taking this step, the company decided to get the plumbers together and talk it over. This was a doubtful move because most of the plumbers were antagonistic. They had worked against gas water heaters and bucked the company continually. But they came to the meeting and they got acquainted. They all pulled out their pencils and figured the cost of selling and a plan was worked up by which the company could sell water heaters for the plumbers' account and get their help in building up the load. And the company men found that the plumbers were a pretty good gang after all and the plumbers' eyes were opened a lot.

So somebody said, "Why not try the same plan with electrical appliances?" This was decided upon and a merchandising plan, which was introduced at the beginning of 1929, was drawn up. In a word, the company offered to purchase and warehouse appliance stock for the electrical dealers so that they could buy as cheaply as the company and secure quick delivery on what they needed. The company offered to finance the dealer's installment sales and to provide supporting services such as home demonstration, advertising, window displays and help from company salesmen. The company would continue to retail appliances also.

Building up dealers

The members of the league were given the first opportunity to participate under this plan, though other merchants who wanted to come in were to be eligible. But the company went to work with the regular electrical trade, called on each dealer and contractor, showed them the opportunity and discussed their financial and experience qualifications for a more aggressive merchandising enterprise. Several of them, unfortunately, got excited, opened larger stores and loaded themselves down with overhead and later cracked up. But in most cases it was a gradual process. The Central Hudson people systematically studied each dealer, coached him in store operation and merchandising methods and counseled him to keep out of retailing where he was clearly not temperamentally or financially fitted for it. In this way the strong dealers were built up and many weak ones were weeded out for their own good as well as the good of the industry.

By the end of the year considerable progress had been made, but the company had reached the conviction that unless it intended to usurp and dominate the sale of electrical appliances it would not be possible to build up a strong and adequate distribution of this merchandise through electrical dealers alone. It also was satisfied that the leading merchants of the communities would not be interested in taking up the line aggressively until they were sure that the power company would not endeavor to control the market. Central Hudson, therefore, decided to discontinue wholesaling appliances to the dealers and announced that it would withdraw from active retailing as fast as other distributors could develop to take over the business.

Second co-operative plan

The plan was to reduce the merchandise sales of the company 50 per cent during 1930. It did not withdraw completely from the sale of any one appliance or in any one district, but it called on the salesmen and supervisors to help develop dealer sales and made it profitable for them to do so. Salesmen were paid a 3 per cent merchandising commission on appliances sold for the company. But they received a larger compensation as a load-building commission, which was paid on all load-building appliances sold in the salesman's district, as follows:

Electric water heater, 30 gal	$12.50
Electric water heater, 60 gal	21.50
Electric range	8.00
Electric ironer	3.00
Flatiron	1.80
Electric refrigerator	
¼ hp. and under	5.50
½ hp. and under	7.00
1 hp. and under	12.00

By offering this opportunity to each salesman to earn a cash commission from dealer sales in his district it was not hard to convince him that it would be more profitable to build up dealer sales than to continue selling only for the company.

At the same time the utility went intensively to work to develop dealer outlets. It systematically canvassed the successful merchants in each town to interest them in entering the appliance business. The first requirement, it was felt, was character and standing in the community, and it believed the job could best be done by established stores that could support this electrical specialty line with other volume and were already selling to the home. But the management studied each town separately, picked the best men and helped them get started.

In one town it was a hardware store, in another a department store and in another perhaps a farm implement dealer who seemed best qualified to succeed. There were several cases where some man in an entirely different type of business saw the opportunity and grabbed it by opening up a new business in electrical appliances. The company worked with those men and gave them the practical assistance they needed. Gradually dealer sales increased and company sales dwindled. Some of the company salesmen went into the retail business for themselves. Some of them were hired by dealers for their new departments.

So on January 1, 1931, the company withdrew entirely from the direct merchandising of appliances, leaving the dealers in complete possession of the market. The dealers were to handle all direct sales and customer service, with Central Hudson providing supervision and

research and financing installment sales. It has been operating on this basis now for 2½ years and has developed a highly specialized supporting organization that helps the dealers through educational work with the customer.

Supporting services

In 1927, when the Central Hudson began active merchandising, it set up a wholesale lighting staff, a power engineering staff, a promotional group to stimulate contractors to wire houses, a rural development section to extend the service out to farms, an architects' and builders' service and a home service staff, to teach the housewife the proper use of electricity and gas, and there was also an advertising department. In 1928 a farm specialist was added and in 1929 several experimental farms were established. In 1930 a home-modernizing group was set up to remodel kitchens and so-called greater service representatives were hired to visit rural homes and check up on appliances in use. In 1931 this greater service work was extended to the cities and the educational work to the farms was increased. The company also began to give assistance to architects and builders on specifications, laying out wire sizes, arranging circuits for them and spotting outlets on their plans where desired.

These special staff services are continued on the functional basis. The company maintains no field salesmen exclusively on appliances. But three territorial supervisors operate in close contact with the dealers. One covers the Newburgh district, where there are 17,000 domestic electric meters. One covers the Pough-

(A) Central Hudson's portable demonstration kitchen is rented through the territory to help all dealers, with an expert in charge.
(B) Here is the Modern Kitchen installed in Schoonmaker's Department Store in Newburgh, where it was demonstrated to Schoonmaker customers.
(C) Central Hudson show windows are loaned to local dealers. This display was installed by a Poughkeepsie furniture store combining electrical appliances and costumes.

keepsie district, with 17,200 domestic meters. The third has both the Kingston and Catskill districts, with a total of 18,600 domestic meters. Reporting to these supervisors are district representatives who work directly with the dealers and also home service demonstrators who follow up the sale of every major appliance, by the dealers, and instruct the consumer in its use.

Dealer development

Out of this process some 23 key dealers have been developed, located in the major communities, and some 148 smaller dealers. The key dealers are the strong stores that have set up an outside sales organization and learned how to co-operate with the Central Hudson corporation in its planning. They have established a sound economic business operation and are forging ahead. Meanwhile, weak dealers have been drifting out. Very few of the original contractor-dealers who used to complain about power company merchandising are left, because they were for the most part mechanically minded men and not merchants.

The business would not yet have developed to a point where the company could step out, however, if it had been necessary to depend on the electrical contractor-dealer alone to provide the stores and the service that the public requires. But to meet the opportunity, established dealers have expanded and new dealers have arisen, each specializing to suit his trade. The retail merchandising of electrical appliances is usually combined with some other sustaining business such as hardware, dry goods, furniture, farm equipment or wiring. These dealers now have 166 outside salesmen working in the territory and 102 of the dealers themselves sell personally. That makes a dealer sales force of 268 at work. The company formerly employed 55 salesmen in the field, but now maintains 21 greater service men, reporting to three district supervisors.

The system is all very simple. District representatives know their dealers and keep in constant touch. Right now in one town the leading department store is just getting started. The company man is in its department every day looking over sales slips, discussing leads, suggesting display ideas and helping to train the outside salesmen. He will continue this close contact until things are running smoothly and the store is making money on range, water heater and refrigerator sales. Then he will give more of his time to some one else. All through the territory these men are cruising around in their cars, out with the dealers or their salesmen, calling on prospects or helping with their planning in the store or office.

Leads and financing

In the district offices of the Central Hudson company the appliances on display are all consigned dealer stock, bearing the dealer's name. People who call there to look at appliances are referred to the dealers for purchase and the dealers are notified. Comparatively little trouble develops in this. Usually the customer expresses a preference for some dealer or store where she trades or there is one dealer in the neighborhood who should have natural preference. The lead goes there. The other cases are referred to several dealers in rotation, and it works out fair to all. Dealers, of course, are not restricted to any territory. They are free to sell where they will, but naturally develop their own clientele within an area convenient to serve.

The most important supporting service, however, is the financing of installment contracts, which the Central Hudson assumes at a charge of 8 per cent per year on the initial unpaid balance, plus 2 per cent to cover losses. The total of the co-operative installment financing was $391,715 in 1930, $402,572 in 1931 and $387,245 in 1932. The company is satisfied to break even on this financing business and the charges have been varied from time to time to adjust the operation to prevailing conditions. Central Hudson has always made a little money on it and the number of repossessions is negligible. In 1931 total repossessions amounted to only 66 units. Repossessed appliances are sold as second-hand equipment by the company. Control over the quality of appliances sold by dealers is exercised through the fact that Central Hudson will finance only appliances that have been approved by the Electrical Testing Laboratories.

Company staff work

Dealer sales have been greatly influenced, however, by various kinds of research and service work which the company has been conducting:

1. Greater service representatives call on every customer once a year to survey their equipment and develop prospects. A complete record of the installation and customer is made on a Hollerith card that provides full information to the supervisor and dealer at all times.
2. Home demonstrators help train dealers' salesmen and demonstrate for dealers.
3. Market studies are made to analyze housekeeping costs and what the housewife wants and what the family budget will absorb. On this basis the financing of refrigerators, for example, has been established so that monthly payments for energy, financing and purchase will about approximate the former cost of ice, food wastage, etc. The household habits of families of different economic status have been studied—what they are interested in—how the need for heat in the kitchen affects the sale of electric water heaters—attitude toward the electric range, etc.
4. A house organ is distributed to all customers, followed by specially trained girls who check up on what women read as a guide to company and dealer advertising.
5. Plans are made up for women who want more attractive kitchens, giving them color sketches of their own kitchens showing recommended equipment, cupboards and draperies and submitting estimates of the cost. Close to 200 kitchen plans are made a year.
6. Special advisory service is extended to farmers to guide them in equipment and wiring, so that rewiring will be unnecessary and mistakes in the selection and use of equipment will be avoided.
7. Layout and specification service to architects and builders is available for customers of dealers.
8. A window display staff lays out dealer windows. This service formerly was free, but a small charge is now being made to encourage the dealer to develop his own merchandising technique. Dealers also use company display windows and are now experimenting with displays that combine electrical appliances with other lines sold by them, such as women's clothes or furniture.
9. Schools for dealers' salesmen are held and the company provides instructors and pays the dealers' salesmen $15 a week for their work and time. The company's personnel department will select these men if the dealer desires, but the dealer is encouraged to find new salesmen among his own employees, who know him and his business. They can be more easily given a knowledge of electrical appliances.
10. Company supervisors act as mediators in clashes between dealers and work out an amicable settlement.
11. Men are trained for the dealers to act as supervisors of their own outside salesmen. One of the most difficult things for the dealer to learn is that if he has five or more salesmen he needs some one to direct them.
12. Semi-annual Central Hudson employee drives on lamps, irons, ranges, water heaters, etc., bring in leads and the dealer

makes the sale. The dealer pays half the commission and the company pays the other half.

13. Twice a year the company holds big meetings for dealers and dealer salesmen. Only producers are invited and each man pays his own way. It builds enthusiasm, launches plans, explains policies and knits the territory together.

This work is all co-ordinated under the control of the sales department, which is responsible for all relations with the customer after the delivery of the energy itself. H. E. Dexter has been general commercial manager in charge since 1927 and has developed this program.

Full-use electric homes

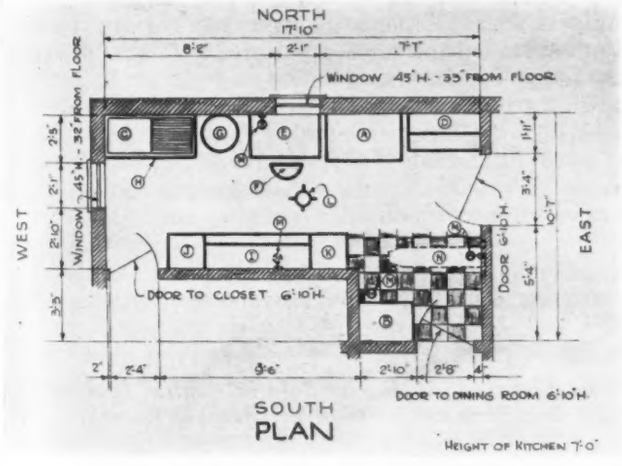
Probably the most important influence on the growth of appliance sales in the Central Hudson territory has been the development of what the company calls the "full-use electric home." Research and experience have developed the fact that a fairly large number of families in that region would be willing to spend $15 a month for service and $15 for equipment, if they could enjoy all the benefits of complete electric service. So the company worked up a plan several years ago whereby a complete equipment could be installed and gradually purchased within that monthly bill.

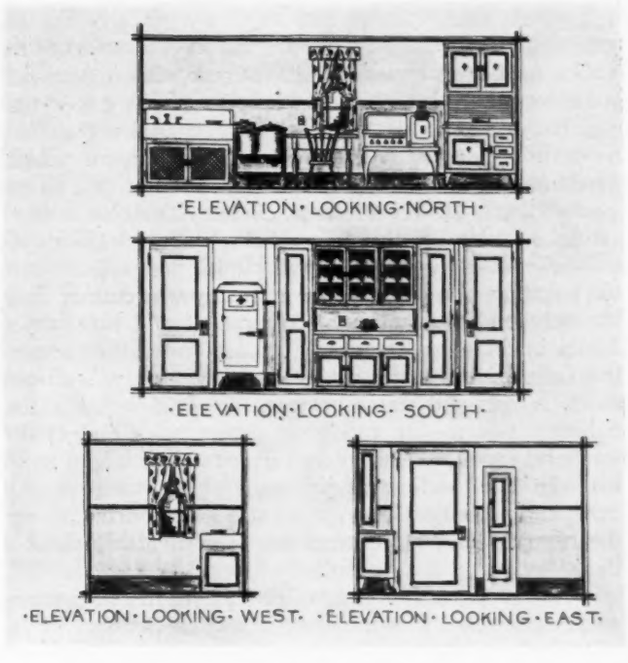
The equipment includes a refrigerator, range, water heater, vacuum cleaner, percolator and flatiron. Where desired, a clothes washer, ironing machine, sun lamp, kitchen ventilating fan and water pump may be added, but these are not required. Additional house wiring may also be included and even plumbing equipment to modernize the bathroom have been financed under the contract, where the customer desires it. But the standard full-use electric home calls for a total annual consumption of 7,000 kw.-hr., for which the customer pays monthly $13.31 for current and $16.69 for amortizing the appliances, and any excess over the 7,000 kw.-hr. is adjusted at the end of the year, the customer paying at 2 cents a kw.-hr.

At this rate the customer will amortize the entire equipment in five years. Where some of these appliances are already installed the time is shorter. Where more equipment is purchased the monthly payment is larger, so that the term will not exceed five years. And if the customer wants to sell the house before the end of the contract the company will arrange to transfer the obligation to the new owner or make some other satisfactory arrangement.

When a dealer finds a prospect for a "full-use" installation he checks with the company at once to secure credit approval and calls for the assistance of the supervisor in the district. When the equipment is satisfactorily installed Central Hudson pays the dealer in full, less 1½ per cent held back for collection cost. The dealer sells at list and provides all service on the appliances. A copy of the contract is filed with the town clerk. Range wiring is negotiated between the dealer and whatever contractor he calls in and is included in the flat price. The contractor is paid by Central Hudson. Range wiring costs on the average $60.

The full-use domestic rate is made up of a monthly facilities charge of 75 cents. To this is added 20 cents per counted room, plus an energy charge of 3½ cents per kilowatt-hour for the first 250 kw.-hr. and 2 cents for the balance. But to the customer it is just a flat





Equipment

Item	Description	Dimensions
A	Westinghouse electric range	43½ in. wide 27½in. deep 48 in. high
B	Westinghouse refrigerator	31⅛ in. wide 22 in. deep 59¾ in. high
C	Sink	52 in. wide 24 in. deep 35 in. high
D	Cabinet	40 in. wide 21⅛ in. deep 68 in. high
E	Table	40 in. wide 25 in. deep 30 in. high
F	Chair	
G	Washer, ABC	
H	Cabinet below sink	52 in. wide 24 in. deep 27 in. high
I	Built-in cabinet	60 in. wide 19 in. deep 7 ft. high
J	Built-in broom cabinet	21 in. wide 19 in. deep 7 ft. high
K	Built-in utensil cabinet	21 in. wide 19 in. deep 7 ft. high
L	Ceiling fixture (200 watts)	
M	Outlets (4)	
N	Built-in ironing board	17½ in. wide 5 ft. 10 in. high

Two pages from a typical kitchen plan as prepared by the Central Hudson Home Modernizing Bureau, as a proposal for modernizing the kitchens of interested customers.

This is one of the strong influences that has helped sell "full-use electric home" installations.

charge, covering energy and appliances to an amount that about balances his former costs for cooking, ice and other duplicating services. The contract is made on a self-renewing yearly basis.

The Central Hudson company purchases the time paper and, by substituting a note for the sale agreement, has been able to sell the notes at a cost of 6 per cent on the unpaid balance and, of course, guarantees payment of the note. The supervisors, in addition to a salary of from $300 to $400 a month, receive plus or minus 50 cents for every 1 per cent increase or decrease in kilowatt-hours in the budget of the district. So they are vitally interested in assisting in the development of all "full-use" homes.

New homes being built, old homes being remodeled and newlyweds are the preferred prospects for "full-use home" contracts and there is keen rivalry between the supervisors and among the more progressive dealers for this business. A chart has been worked up that shows the varying charges on installations financed on from 36 to 60 months, and all the sales resources of the dealer and the company are brought up to close these contracts. As a result, about 150 complete electric homes have been developed in the territory.

This has had far-reaching influence, for it is an ever-present demonstration that electrical appliances can be sold and that the use of electrical equipment for labor saving and comfort is not too expensive for the small modern home in Central Hudson territory. It acts as a continual stimulus to the dealer and to the company supervisor. It answers the arguments of the customer who says "Electricity costs too much." It foils the salesman who says "They can't be sold." It sets a bogey and men are selling up to a high standard.

As to results

Out of all this experience have come some figures and some testimony by which the success of the experiment can be judged. The figures are not as full as could be desired, but that is natural because there was no way of estimating dealer sales before the present system was worked out. However, the accompanying table is interesting. Totals for the years 1927, 1928 and 1929 show only the sales of the Central Hudson Gas & Electric Corporation. But in 1930 the company was cutting down its merchandising activity 50 per cent and building up dealer business and secured a report from all dealers on the sales of the three major appliances only—refrigerators, ranges and water heaters. In 1931 it had set up a better system for reporting dealer sales and clothes washers, vacuum cleaners and ironers were added to the list. In 1932 radio was included. Unfortunately, flatirons and table appliances were still not reported, though the returns were more accurate. But this tells most of the story in terms of load.

A better reflection is obtained from the comparison of per customer consumption over this period. It has practically doubled in five years, as the table shows, and now stands six points above the national average. And when you consider that selling has been increasingly difficult for the last few years, here is evidence that the Central Hudson plan is working.

The important point, however, is whether or not the program is developing independent distribution in the territory and building up stronger dealers who will sell more appliances than the power company could alone. You can't get this kind of evidence out of a column of figures, but you can get it in the field. I have, therefore, just been visiting the principal towns of the Central Hudson territory talking to the local merchants, asking them how they like the present system and drawing out their comments and their criticism. I found a practically unanimous indorsement of the present Central Hudson plan.

The merchants like it. They like it because it is helping them in their own business. Also, they think the company is smart because the present policy has won a lot of new friends and supporters among retailers who in the past have criticised and complained at what they considered unfair competition. They used to knock the company and take it out on it by kicking at their light bills, but now they are in partnership and pulling together. They are getting more business and the utility is getting more load. A few cases, shown in the accompanying panel, may be of interest.

I talked to many smaller dealers. I attended an evening meeting of farmers and their wives given by one dealer in a rural community, organized around the Central Hudson portable model kitchen and some moving pictures. All of these dealers are keen for the advantages that the new plan has brought them and are optimistic over the future. I sought out two merchants who had previously been open enemies of the power company and found them now strong in approval.

Sundry criticisms

In a word, the trade is now solidly behind the Central Hudson company in this program. Those who used to be antagonistic now agree that the company is fair and honest in its co-operation and that they are getting more business today through the assistance of the Central Hudson staff than they ever enjoyed before. There are

Growth of Domestic Electric Consumption

Year	No. Customers	Kw.-Hr. per Customer	Per Cent Increase
1927	32,649	313	....
1928	37,476	362	15.6
1929	42,161	416	14.9
1930	46,116	499	19.9
1931	48,770	556	11.4
1932	51,876	607	9.2

Total Electrical Appliances Sold in Central Hudson Gas & Electric Corporation Territory, as Recorded

	Central Hudson Corp. Only			Both	— Dealers Only —	
Appliance	1927	1928	1929	1930	1931	1932
Clothes washers	460	433	344	.....	1,737	1,571
Dishwashers	5	3	0	.....	.....	.....
Vacuum cleaners	489	299	468	.....	1,203	1,196
Ironers	176	93	55	.....	237	140
Refrigerators	850	1,427	2,155	2,357	2,917	3,042
Ranges	67	168	511	538	373	383
Fans	150	233	324	.....	.....	.....
Eliminators ("B" battery)	178	10	0	.....	.....	.....
Irons	2,231	4,322	324	.....	.....	.....
Space heaters	286	212	324	.....	.....	.....
Water heaters	9	30	121	120	166	150
Cookers	27	41	43	.....	.....	.....
Toasters	652	592	600	.....	.....	.....
Percolators	448	433	801	.....	.....	.....
Waffle irons	314	444	405	.....	.....	.....
Radios	.....	.....	.....	.....	.....	1,743
Total estimated consumption	1,085,570	1,463,732	2,188,253	2,545,000	2,961,010	3,172,000

Some Good Examples

1. An old conservative department store has opened a special department and is now selling about $50,000 worth of appliances a year. One of the Central Hudson supervisors is giving it practically his entire time. It is financing its sales with the company and this makes it a cash business. It is highly pleased and expects its sales to increase greatly.

2. A furniture house says that it is receiving a "super service" from Central Hudson. Its sales have grown greatly and the whole appliance business has been stabilized by the company financing.

3. A small town dealer, with five salesmen selling outside on commission (with a 15 per cent drawing account) says the plan gives an ideal set-up for him. It provides ample credit without the dealer requiring more capital or credit than he needs for his normal operating requirements. This man has two sub-dealers, selling from country general stores. The greater service men are invaluable to him.

4. A leading hardware dealer sold no appliances until Central Hudson quit. Now he has a model kitchen display and outside salesmen and his business is growing steadily.

5. Another department store has sold appliances for eight years, but has seen a big spurt under the new plan. The fact that he can sell on installments, without recourse, gives him a great advantage over conditions in other cities served by his chain. He has four outside salesmen and gets great assistance from the company's home service girls and the supervisor.

6. Another furniture store gives one story after another of how the plan helps it sell and the gains in business that have followed.

7. Another department store with twenty salesmen out has built up its appliance department under the new plan until now it provides 20 per cent of the gross volume of the entire store and 10 per cent of the gross profits. The company's finance service has made this possible because it frees the store from contingent liability on the installment contracts and does not involve its credit at the bank.

8. A jobbing house told me that this plan is proving a powerful influence for stabilizing distribution by keeping it in the natural channel of manufacturer to wholesaler to retailer. The dealer, he says, now employs a much higher type of salesman than he could afford if he had to finance his own sales and trade is on a more orderly basis.

some criticisms, of course, but they are over details that will gradually be cleared up.

One man objects because any dealer can take advantage of the company financing. He says that it hands a crutch to the small retailer who should not be in the business. But another takes the opposite view and argues that it helps toward harmony in the trade, because the small man feels that he has an equal opportunity to succeed.

For some peculiar reason, men will talk freely to an outsider when they will not complain to the company. But in all my contacts the only complaints I found were on the minor details of operation. Several dealers doubted if they were getting their full share of leads. Several thought they were not getting help from the home demonstrators on as many sales as they should. One thought the company could do a better job in making all dealers co-ordinate their advertising. In my opinion, there is no trouble here except that these dealers do not realize just how much help they really are getting. In some cases the department manager knew how many leads were coming from the Central Hudson, but the head man did not. A more effective system of reports that will remind the dealer regularly of just what assistance he is receiving is probably all that is needed.

Why this success

I am convinced from what I have seen that this Central Hudson plan is working. Certainly that is the consensus among the dealers there. The plan is selling more appliances, building more load and making more friends for the utility than when it was merchandising. This does not mean to me that all power companies should quit selling appliances. I believe in power company merchandising—but that's another story.

The point here is that the Central Hudson Gas & Electric Corporation has succeeded in developing a system of practical co-operation with its local dealers that is resulting in more appliance sales, increased load and improved trade relations. The company itself is not doing any actual retailing, but it is actively assisting the dealers in their merchandising operation and providing an extensive supporting service, without which they could not be accomplishing what they are today. The company is not merchandising, but it is doing an elaborate and intelligent job of load building through dealers, and that is something very different from just quitting the sale of appliances and leaving it to the trade with its best wishes.

The success of the present program has been dependent, above all, upon the fact that Central Hudson has devoted more than three years to patiently building dealers, and is financing their installment sales at a low rate without recourse on them. Three men I talked to are selling appliances in territory served by Central Hudson and two other power companies. One of these companies merchandises. The other does not, but though it actively co-operates with these dealers in other ways, it finances no installment paper. These men all said that the Central Hudson plan is getting more appliances sold through the dealers and building more load than where the other utilities are operating. They are enthusiastic about the business they are securing in the Hudson Valley. But the thing that means the most to all of them is the financing.

▼

Improved Benson Boilers

Detailed plans are said to have been completed by the Siemens-Schuckertwerke of Berlin for improved development of the Benson under-critical pressure boilers. It is reported that this organization has projected a peak-load central station with 500 lb. normal and 2,000 lb. peak pressure, giving a turbine output from 5,000 kw. to 20,000 kw. The operating advantages of the variable-pressure plant are cited; first costs, referred to maximum capacity, are said to be low.

Since the pressure can at all times be adjusted to the load there results a turbine in which the efficiency is practically unchanged from light load to full load, with exceptional virtue under widely fluctuating loads.

Fire Protection Modernized

By E. B. SHEW

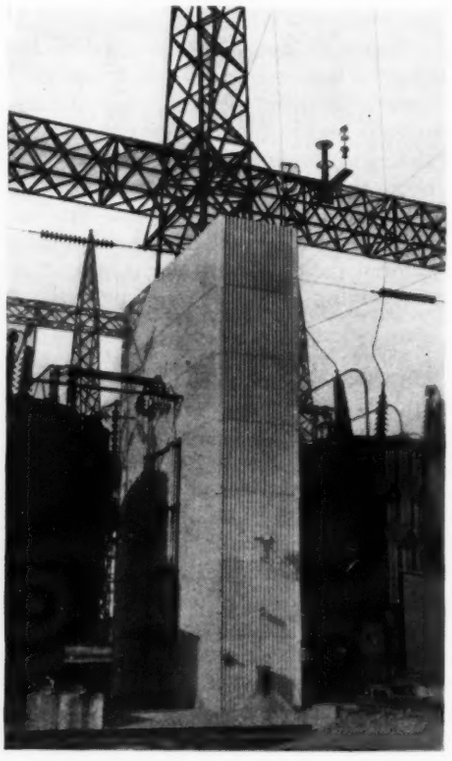
Engineer Inside Plant, Philadelphia Electric Company

THREE methods which can be employed, separately or in combination, to reduce fire hazards to a minimum are: First, selecting equipment that is least liable to start a fire; second, arranging equipment so that damage from fire is minimized, and third, providing adequate fire-fighting facilities to extinguish a fire. The first method is, of course, the most desirable, but since non-inflammable materials cannot be used exclusively, it is impracticable as a complete solution to the problem. The second method deserves serious consideration and should be used in all new designs and wherever possible in modifying and adding to existing plants. However, there are many old plants that will continue in service for a number of years, so that the third method must be relied upon principally to reduce hazards in these cases. Consideration should be given to the erection of fire walls and barriers, replacement of inadequate oil circuit breakers, methods of disposing of oil released by equipment failure and reduction in the quantity of inflammable materials. A review of past fires has revealed that burning oil expelled from damaged apparatus has spread along the ground, causing considerable damage to adjacent equipment and may possibly weaken concrete foundations and steel structures.

To minimize the damage resulting from fire among electrical equipment, the Philadelphia Electric Company system was surveyed with a view to modernizing fire preventive and combative measures.

Generating Stations—In the Conowingo hydro-electric plant there is a step-up substation consisting of four 80,000-kva./13.2-220-kv. transformer banks and seven 220-kv. oil circuit breakers. The transformers are in individual cells open on one side except for a barrier of sufficient height to retain the oil in event of failure, with drains in the floor to carry the oil away. A single powder foam system, permanently piped to outlets in each transformer cell, is located in a pipe tunnel immediately adjacent to and at a height above the main transformers, with peepholes in the tunnel wall arranged so that attendants can observe conditions in the cells when operating the foam system. The 220-kv. oil circuit breakers are located on the roof of the station and a battery of carbon dioxide cylinders is piped through individual valves to each oil circuit breaker tank. Hose connections are available at convenient locations on the roof to supply foam from the permanent system for use on burning oil expelled from a breaker. The main generators are equipped with perforated pipe rings which can be connected to the water supply system by means of flexible hose with snap couplings. For miscellaneous protection around the plant six 40-gal. portable foam engines, each furnished with 50 ft. of hose, are provided in addition to a complement of hand carbon tetrachloride extinguishers. A fire alarm system, with pull boxes at convenient locations and an indicator in the operating room, assists in rapidly reporting the location of a fire so that men and equipment can quickly be dispatched.

Switch-houses in steam-generating stations are divided into a number of sections by transverse fire walls with bus sectionalizing disconnecting switches on both sides of each wall so that a section of bus rendered inoperative can be quickly isolated, thus permitting the restoration to service of the unaffected sections. In one station constructed with vertical phase isolation a longitudinal wall

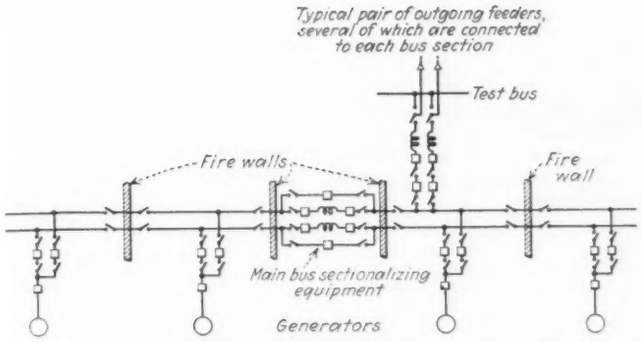


Fire barrier between adjacent transformer banks

The wall extends 3 ft. above the high-voltage bushings and 3 ft. beyond the sides of the transformers.

Fire truck with 40-gal. unit attached

Note cans of powder in forward compartment and foam generator with 400 ft. of hose in rear compartment, also method of attaching 40-gal. foam engine.


Typical pair of outgoing feeders, several of which are connected to each bus section
Test bus
Fire walls
Fire wall
Main bus sectionalizing equipment
Generators

Typical arrangement of fire walls in generating station switchhouses

One generator and several outgoing feeders are contained in each room with the main bus sectionalizing equipment in a separate room. Disconnecting switches are located on both sides of each fire wall in order to permit quick isolation of a faulty section of the bus. The walls consist of 6 inch hollow tile with a facing of one-half inch of cement. Metal clad wood doors, normally closed, provide access to the various aisles. The outgoing feeders are so arranged that failure in one section of the switchhouse will not completely interrupt service to a substation.

separates the duplicate buses and in addition two transverse walls form a central corridor between bus sections. The generators are equipped with pipe rings similar to the scheme used at Conowingo. Portable 40-gal. soda and acid extinguishers and hand type carbon tetrachloride extinguishers are provided. Fire alarm systems are used similar to Conowingo.

Transmission Substations—Plymouth Meeting substation forms an important junction point for the Pennsylvania-New Jersey 220-kv. interconnection lines and those from Conowingo hydro-electric station. From this substation power is delivered at 66 kv. via five lines into the transmission system. The present outdoor equipment comprises fourteen 220-kv. oil circuit breakers, three 130,000-kva./220-66-13.2-kv. transformer banks, six 220-kv. metering units, six 220-kv. potential transformers, twelve 66-kv. oil circuit breakers, one 30,000-kw./66-33-kv. transformer bank and five 33-kv. oil circuit breakers containing in all approximately 470,000 gal. of oil. The substation building houses three 30,000-kva. synchronous condensers and is arranged with a pit and platform at one end for repairing high-voltage equipment.

Two of the large transformer banks are so located that an oil fire originating in a transformer of one bank might spread to the units of the adjacent bank. In order to prevent this a barrier of corrugated sheet asbestos lumber was erected between the banks and an area around the transformers was covered with large stones to a depth of 18 to 24 in. There is a similar area of stone fill around the oil circuit breakers in order to prevent the spread of burning oil that might be expelled from the tanks in the event of failure. In addition to retaining spilled oil, these stones act as a cooling medium and break up the oil into small quantities, thus tending to extinguish the burning oil by reducing its temperature.

A two-powder foam generator is provided having a capacity of 800 gal. of foam per minute, which, due to the large area occupied by this substation, must be arranged so that it can be quickly moved to the desired location. For this purpose a specially designed body was mounted on a 1½-ton Ford truck chassis. The front portion of the body is inclosed and contains 1,500 lb. of foam powder in dual containers; the rear portion is open and accommodates the foam generator and 400 ft. of hose. Hydrants are located at strategic points in the yard to supply water to the foam generator. The generator is capable of throwing a stream of foam approximately 70 ft., with a most effective range of 50 ft., and operates most efficiently with a water pressure of 100 lb., consuming at this pressure approximately 100 gal. of water per minute. Only two men are required to operate the foam generator, one feeding powder into the funnel and the other directing the foam on the fire. In addition to the 1,500 lb. of foam powder normally caried on the truck, 2,000 lb. is stored in the station so that a reserve supply is available for an unusually large fire or to replace the original 1,500 lb. on the truck until a replacement order is filled. A portable 40-gal. foam engine has been supplied for combating small fires not requiring the use of the large foam generator; a hook on the rear of the Ford truck permits the foam engine to be rapidly moved around the substation.

A battery of four carbon dioxide cylinders immediately outside of the repair building is temporarily connected to oil-filled apparatus by a flexible hose when undergoing repairs. This system is manually operated.

The synchronous condensers are protected by pipe rings similar to the method used for the generators at Conowingo.

At other transmission substations areas of stone fill have been provided around oil-filled equipment where practicable. In general, fire barriers have not been erected in these substations, the one exception being in an important outdoor 13.2-kv. yard, where a concrete wall longitudinally divides the substation into two parts. One, two or three 40-gal. portable foam engines are provided, depending on the size of the substation.

Unattended Suburban Substations—Hand type carbon tetrachloride extinguishers are supplied to unattended suburban distribution substations and an area of stone fill is provided around oil-filled equipment in the outdoor yards. A study, including a series of field tests, was recently made to determine the suitability of automatic systems for protection of the 4-kv. equipment which is housed in a brick building. The various systems considered included carbon tetrachloride suspended in individual containers, carbon tetrachloride piped from a main tank to spray nozzles located at the equipment, powder, and carbon dioxide. However, in view of the cost, it was decided that automatic fire protection would not be installed, at least for the present. There is one unattended substation with air-blast transformers indoors protected by an automatic carbon dioxide system which is selectively operated either from differential relays or from a temperature device at the top of the transformers. Automatic directional valves are arranged to introduce the gas into the unit in trouble.

Attended Urban Substations—Attended urban distribution substations are equipped with the usual complement of hand type carbon tetrachloride extinguishers. In the later substations the 13.2-kv. buses and oil circuit breakers are separated from the 2,400-volt equipment by a wall and further divided into three sections by two fire walls which inclose the bus sectionalizing equipment. Thus a fire originating in one section of the substation will not cause a total interruption.

The fire marshal of the safety department makes periodic visits to all of the company's properties and inspects the fire-fighting apparatus and also brings to the

attention of the proper department conditions which in his judgment constitute fire hazards. Periodic fire drills are conducted at all generating stations and at Plymouth Meeting substation in order to obtain the highest efficiency in the use of fire apparatus in emergencies. In determining fire protective requirements, close co-operation is maintained between the engineering department and the fire marshal in order to obtain the benefit of his broad experience in this field.

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Synchronizing and Pitting of Propeller Waterwheels

Reports on 27 plants containing 63 propeller-type units, totaling 752,370 hp., have been secured by a committee of the Canadian Electric Association.* E. V. Caton, chairman, reports that while several of these plants have had considerable maintenance expense, due to pitting of the runners and stationary rings, as a whole the records of this type of waterwheel are very satisfactory. Differences in the operating characteristics, as compared with slower speed Francis units, has caused some inconveniences when the plants were started up, but in the majority of cases they have ceased to be considered as difficulties after the operators have become accustomed to the units.

Ten plants were of the opinion that propeller-type units were harder to synchronize than Francis units, but sixteen reported that they were not. The general opinion of the first group was that the difficulties are often overcome by experience in operating the units. Six plants reported that venting of the draft tube aids synchronizing, while an equal number say it does not. Fourteen have not tried both methods, so comparisons could not be reported. Eight plants reported that high tailwater makes synchronizing more difficult, but ten did not experience any trouble from this cause. One reported that high tailwater actually aided synchronizing. Six had had no experience with high tailwater.

Slight vibration, not serious, was reported by six plants, but 21 reported no trouble from this cause.

Five plants containing twelve units reported severe pitting on the runners, and eight plants with fifteen units slight erosion or bright spots on the runners. Comparison of the plants by draft head, specific speed and cavitation factor throw no light on any relation between these factors and pitting and erosion. Characteristics of design, not brought out in the data collected, evidently have an influence. For example, some parts of the blades may be incorrectly shaped, comments the reporting committee. The projected area of the runner also influences the vacuum per square inch of blade.

The only inference drawn from the reports by the committee is that certain metals are more subject to pitting than others. For example, one company which had had severe pitting of the trailing tips of runners reported:

> After spending considerable sums on building up affected areas by welding, both with special alloys and ordinary steel, and then grinding smooth, it was found cheaper to cut out the faulty part, machine a piece of plate steel to match and weld it in. It is significant that these plate steel tips have shown no signs of pitting. This indicates that a good deal of the trouble on the runner tip is probably as much due to unsuitable material as to fault in the design of the runner. It is suggested that this may be due to the difficulty in securing good metal at the thin tips when casting, and the cure for the trouble would be by building the trailing tips of this type of runner with steel plate welded to the main body of the cast steel blades.

Another company reported that bad pitting of the base ring at points in line with the full-open position of the guide vanes had been greatly retarded by welding these areas with stainless steel. Repairs are now needed only every two years instead of every year. Stainless steel welding has also been found effective for reducing the pitting on runner blades.

A great reduction in pitting of the runners and base ring was reported by one company after two years' operation with no apparent cause.

Still another plant states that the surfaces of the runner and base ring were welded with chrome nickel before installation and so far (after three years) no signs of erosion have occurred.

The plants covered in this Canadian survey had units ranging from 400 to 37,500 hp., heads of 8 to 66 ft., speeds of 85.7 to 400 r.p.m., specific speeds of 105 to 211 and runners of 58 to 200 in. diameter. Fixed-blade turbines predominated, although there were some manually and automatically adjustable-blade units. Steady loads were carried by about two-thirds of the plants. The elevation of the tops of the runners above tailwater ranged from —24 to +12 ft.

Room 409 Power Building, Montreal.

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READERS' FORUM

Field of Mercury Rectifier Broadened

To the Editor of the ELECTRICAL WORLD:

Through misunderstanding, my discussion of J. H. Cox's paper on mercury-arc rectifiers at the recent A.I.E.E. convention in Chicago was reported in ELECTRICAL WORLD of July 8 (page 47) as just the opposite of what I meant to convey, as follows:

> Not only is the rectifier now the proper device for ordinary rectification in many cases where it previously could not compete with rotaries and motor-generator sets, but such applications as the regulation of induction motors with a rectifier in the secondary and many other possibilities previously suggested are coming closer to a practical and economical realization. In fact, with recent developments relating to the regulation and control of mercury-arc devices, it seems that they are destined to play a most important part in all applications where appreciable amounts of power are involved. At the same time it seems that the field of application of many electronic devices which have come with the advent of radio developments and with regard to the future of which many exaggerated and over-optimistic claims have been made may be limited to smaller amounts of power, certain control problems and some special applications. The necessity of heated cathodes in these devices and the limited life are, after all, appreciable handicaps. On the other hand, it seems that the future of the pool-cathode mercury-arc devices, the development of which was originated in connection with power applications, is becoming brighter every day as the basic factors entering into their design and operation are becoming better understood.

R. E. HELLMUND,
Chief Engineer.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Men of the Industry

O. E. Buckley to Direct Research for Bell Laboratories

Oliver E. Buckley has been appointed director of research of Bell Telephone Laboratories to succeed the late H. D. Arnold. Dr. Buckley has engaged in research work for the Western Electric Company and for the Bell laboratories since his graduation from Cornell University in 1914. At that time the early work on wireless telephony was proceeding rapidly and Dr. Buckley was assigned first to the study of mercury-arc oscillators and later to the development of power tubes and to the improvement of vacuum technique generally, to which he made several important contributions. After demobilization following the World War Dr. Buckley returned to the laboratories, where he began an investigation of submarine telegraph cables. He worked on the various phases of the problem of the loaded cable, and so encouraging were the prospects Dr. Buckley reported that backing for the work was forthcoming and the development work began, from which evolved a new era in submarine cable telegraphy. Following the laying of the Western Union's cable from New York to the Azores, in 1924, many other cables were made and laid under license from the Bell System, and Dr. Buckley acted as consulting engineer for most of them. In 1927 he was appointed assistant director of research, and at that time, in addition to the work he had been handling previously, was given supervision of the group conducting researches in the field of wire transmission. Dr. Buckley is a fellow of the American Institute of Electrical Engineers, American Association for the Advancement of Science and the American Physical Society and a member of the Franklin Institute.

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DWIGHT R. G. PALMER has been elected president of General Cable Corporation to fill the vacancy caused by the resignation of H. T. Dyett. F. M. POTTER has been elected vice-president and director of sales to fill the vacancy made by the election of Mr. Palmer to the presidency.

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WINTHROP W. ALDRICH, president of the Chase National Bank, was elected a director of the Westinghouse Electric & Manufacturing Company at a recent meeting of the board. In addition to the directorship to which he was elected Mr. Aldrich is a director of the Chase National Bank, the American Telephone & Telegraph Company, American Express Company, Discount Corporation, Rockefeller Centre, Inc., and other companies.

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GEORGE L. DRAFFAN, formerly secretary of the Ohio Brass Company, was elected vice-president of the company and its subsidiaries at a recent meeting of the board of directors. Mr. Draffan has been associated with Ohio Brass for the past seventeen years. In 1930 he was elected secretary and director of sales, after having held the position of general sales manager for several years.

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LEWIS H. HARDIN has been appointed head of the engineering staff of the new Georgia Public Service Commission. Mr. Hardin was selected for this position on the recommendation of C. A. Mees, consulting engineer, with whom he had been associated for twelve years in the design and construction of hydroelectric plants in North Carolina. Mr. Hardin was formerly identified with the engineering staff of the Texas Power & Light Company in Dallas and with the Texas Electric Service Company in Fort Worth in the capacity of superintendent of the construction department.

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PAUL DOTY, chairman of the Minnesota State Board of Registration for Architects, Engineers and Land Surveyors, was nominated for the office of president of the American Society of Mechanical Engineers at the recent meeting of that association in Chicago. Mr. Doty has been identified with the gas industry most of his life. Following graduation from the Stevens Institute of Technology in 1888 he became identified with the United Gas Improvement Company and in 1895 with the late Emerson McMillin of the American Light & Traction Company, New York. Early in his career he held executive positions with gas companies in various sections of the country. In 1903 and 1904 he was vice-president and general manager of the Denver Gas & Electric Company, in 1904 was made vice-president and general manager of the St. Paul Gas Light Company, the St. Croix Power Company and later the South St. Paul Gas & Electric Company. From 1905 to 1910 he was president of the Union Light, Heat & Power Company of Fargo, N. D. Mr. Doty was with the McMillin interests until 1917, when he entered the service of the United States in the World War. He has served as chairman of the Minnesota Board of Registration continuously since its organization in 1921. He has been actively engaged as advisory engineer to St. Paul financial institutions, particularly in regard to public utilities, in which he has important interests. In addition to being active in the American Society of Mechanical Engineers, Mr. Doty is a member of the American Institute of Electrical Engineers and of other engineering societies.

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E. W. BOWNESS has been appointed vice-president of the Dominion Gas & Electric Company and its various subsidiaries, including the Calgary and Edmonton Gas companies, Canadian Utilities, Ltd., Union Power Company, Ltd., and the Nanaimo and Duncan Electrical companies. Mr. Bowness for some years past has been a director of the operating companies and manager of the electrical subsidiaries of Dominion Gas & Electric. At one time he was a professor of engineering at the Case School of Applied Science, Cleveland, Ohio, later was connected with the public utilities in Portland, Ore., and was manager of the light and power department of the Mount Hood Railway & Power Company.

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OBITUARY

RODOLPH L. AGASSIZ, a member of the directorate of the Edison Electric Illuminating Company of Boston and president of the Calumet & Hecla Consolidated Copper Company, died at his summer home in Prides Crossing, Mass., July 31, at the age of 61.

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FRED S. BARTON, manager of the municipal electric lighting department of the town of Norwood, Mass., since its establishment 26 years ago, died suddenly, of a heart attack, July 31, at his home in that municipality. He was 67 years of age.

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FRANCIS LINCOLN O'BRYAN, district manager of the Edison Electric Illuminating Company of Boston at Framingham, Mass., for the past twelve years, died at his home in that city, August 1, after a short illness. He was born at Martinsville, Va., 56 years ago, and for some years was electrical engineer of the Boston & Worcester Street Railway before entering the central-station field. He was an inventor of considerable note in the field of electric signaling and motor applications.

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EDWARD C. JONES, some few years ago chief engineer for the Pacific Gas & Electric Company, died, of a heart attack, July 23, at his home in Palo Alto. A native of Boston, Mass., and a graduate of the Massachusetts Insti-

tute of Technology, Mr. Jones went to the Pacific Coast and became chief engineer for the San Francisco Gas Light Company, which became the Pacific Gas & Electric Company in 1906. He remained with the company until his retirement in 1920.

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HERMAN POLLARD, 61, superintendent of transportation for the Virginia Electric & Power Company, died at his home in Richmond, July 27. He had been in ill health for the past two years.

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HENRY P. BRUMELL, designing engineer for the General Electric Company, Bridgeport, Conn., was drowned in a pond in Danbury, Conn., July 8. Mr. Brumell was 36 years old and a graduate of Columbia University.

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CARYL P. FIGG, assistant treasurer of the Montaup Electric Company, Fall River, Mass., died at his residence in that city July 7. He was born at Richmond, Va., 42 years ago and had been associated with the Montaup and Fall River utility organizations for the past seven years.

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W. C. MANGELS, system operator, electric department, Public Service Electric & Gas Company, Newark, N. J., died July 16 in his fiftieth year, following an operation. Mr. Mangels had been associated with Public Service and predecessor companies during his entire career and had held the position he occupied at the time of his death since 1919. He was a member of the American Institute of Electrical Engineers.

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ARTHUR P. DAVIS, internationally known engineer and prominently identified with the Boulder Dam project, died at Oakland, Cal., August 7, after an illness of several months. He was 72 years of age. Mr. Davis served the government many years, but had been out of its service about a decade when, last July 10, he was again chosen a consulting engineer in the new Bureau of Reclamation on the Boulder Dam project. He was credited with first envisioning Boulder Dam, and during his 21 years as an engineer in the Department of the Interior worked consistently for its construction. His last big undertaking was the supervision of the building of a hydro-electric system for the Soviet Government, upon the completion of which he returned to this country from Russia about a year ago. Mr. Davis was born in Decatur, Ill., in 1861 and received his technical education at George Washington University, Washington, D. C., and at Iowa State College. He was a past-president of the American Society of Civil Engineers and of the Washington Society of Engineers and a past-vice-president of the Washington Academy of Sciences.

New Equipment Available

Recording Thermometer and Pressure Gage

An improved line of 8- and 12-in. circular chart instruments including thermometers in indicating and recording types for temperatures from 40 up to 1,200 deg. F. and gages for ranges from 10 in. of water up to 5,000 lb. has been announced by the Brown Instrument Company, Philadelphia, Pa. In the pressure and vacuum gages three different types of actuating movements are employed. For ranges 10 in. of water to 30 lb. a flexible metal diaphragm is used. For ranges 30 in. and 200 lb. a spring-opposed bellows has been developed which gives a powerful pen action in this range. For pressures over 200 lb. a helix is used. Some of the new features include handy toggle switch to start and stop electric clock, combination door handle and built-in lock, automatic chart clips carried on door hold chart in place, etc.

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Rubber-Insulated Cable

Three new types of rubber-insulated cable, insulated with heat-, corona- and moisture-resisting compounds, have been announced by the General Electric Company.

Rubber insulation designated as Type GE-R359 is designed to operate at a maximum temperature not exceeding 75 deg C. It is recommended for insulating cables for station, apparatus, transformer lead, motor lead, and power applications where a cable is required to be insulated with a compound which will stand much higher temperatures than the standard grade of rubber compounds previously available. It can be furnished with any type of finish.

The new Type GE-R348 moisture-resisting compound is designed for use on cables which must operate in wet locations. It is particularly adapted for non-leaded submarine cables. This rubber compound is not corona-resisting, so that for higher voltage it is necessary to apply a shielding type.

The third new compound, Type GE-R351, is a corona- and moisture-resisting compound which retains its original characteristics throughout its life. It is recommended on cable for high-voltage transmission, distribution, station, apparatus, parkway, tree wire, aerial, submarine, and similar applications where a corona-resisting, high-tension, non-leaded or leaded cable is required. This type of compound is used to form the entire insulation over the conductor since it has both high dielectric and corona-resisting properties.

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Portable Oscillograph

Differing greatly from previous designs, an entirely new oscillograph using a new type of optical system and galvanometer has been announced by the Westinghouse Electric & Manufacturing Company. This instrument may be used as conveniently as an ordinary voltmeter or ammeter and has other characteristics which will extend the range of application of oscillographic instruments.

The instrument is entirely self-contained and may be operated from a 110-volt, 60-cycle lighting circuit without auxiliary attachments. Some of the new features include simultaneous viewing and photographing, a continuous time axis furnished by a small revolving mirror whose speed is variable, a new type of galvanometer with electromagnetic damping and high-frequency response, etc.

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HIGH TORQUE CAPACITOR MOTORS providing overload capacity in excess of 100 per cent, unusually cool-running characteristics and special adaptability to the needs of compression equipment operation are announced by the Emerson Electric Manufacturing Company to supplement its existing line of low torque fan-duty capacitor motors. The new motors are designed to be super-quiet with unusually close air-gap tolerances and other precision refinements. They are available in sizes of $\frac{1}{8}$ to $\frac{1}{3}$ hp. with resilient or rigid mountings

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FOAM GENERATOR known as the "Phomene Hopper," embodying new ideas of design and construction, has been announced by the Pyrene Manufacturing Company, Newark, N. J. It is a device for converting a fire line from a continuous water stream to a continuous foam stream. This unit is coupled into a hose line. Water enters one side, Phomene powder is poured in the hopper and foam is discharged through the hose line at the other side of the unit. It is claimed that the flow of powder is governed automatically by the pressure and amount of water available and that the device operates efficiently with water pressure as low as 35 lb. An auxiliary water jet in the hopper erodes the powder and flushes it into the main water stream passing through the base.